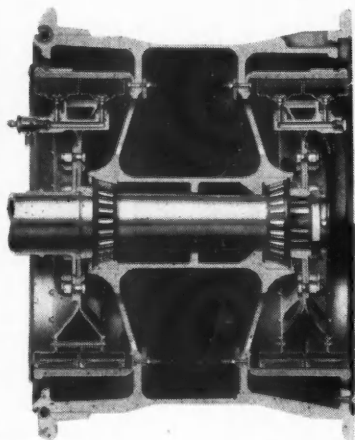
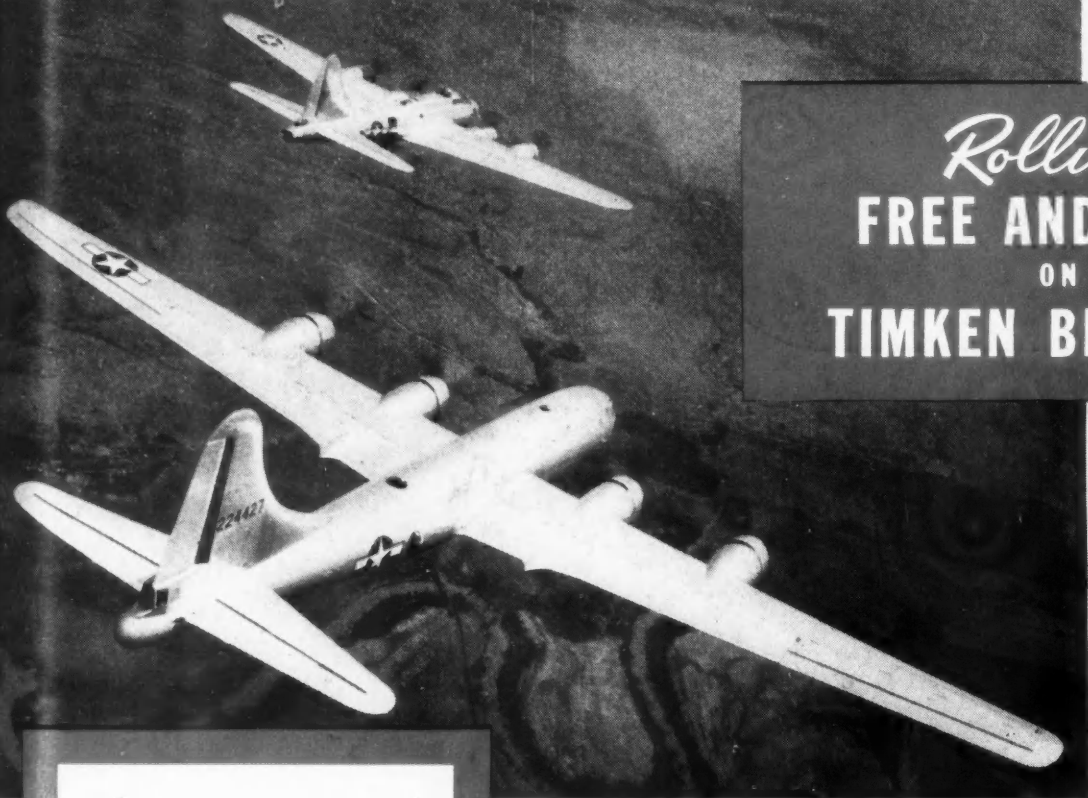


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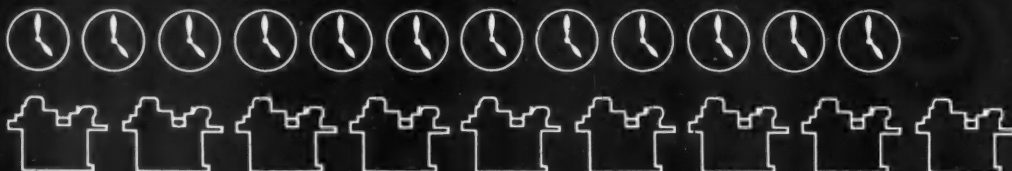
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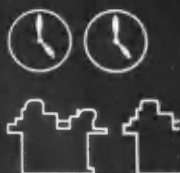
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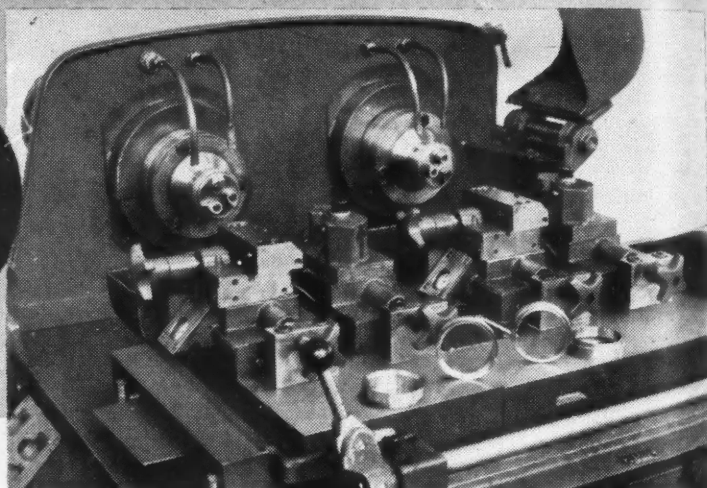
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AUTOMOTIVE and Aviation INDUSTRIES

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May 15, 1945

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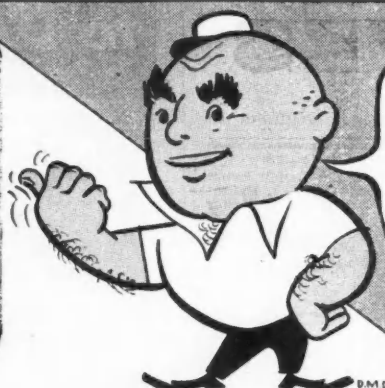
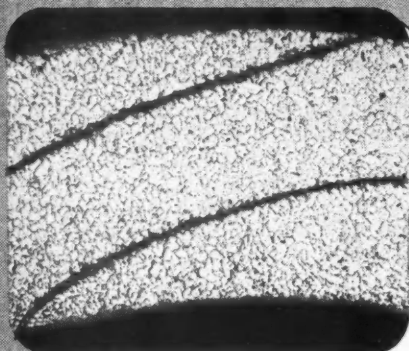
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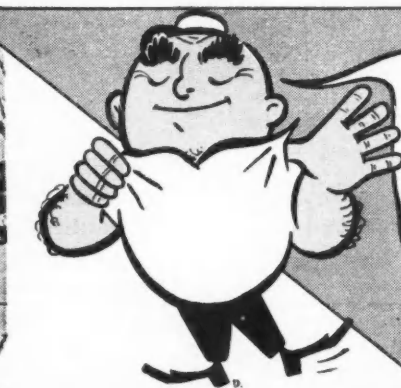
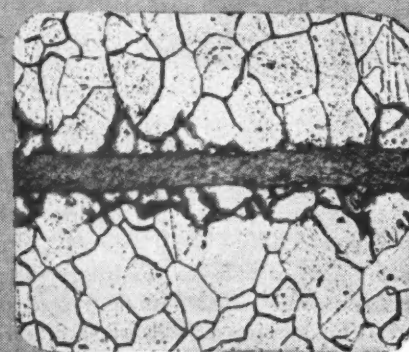
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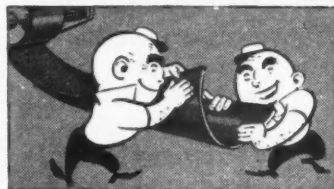
SMOOTH JOINT . . . Note in this photomicrograph how the beveled edges of the strip produce a tube uniformly smooth on the outside and with no inside bead.



SOLID DOUBLE WALL . . . And note here how Bundyweld is made from a single steel strip laterally rolled twice for strength.



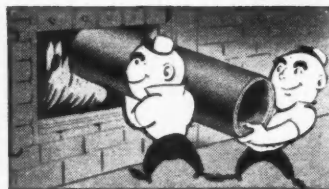
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2...into tubular form. Walls of uniform thickness and concentricity are assured by the use of close tolerance cold rolled strip. This double rolled strip passes through a furnace where the...



3... copper coating fuses and alloys with the double steel walls. After brazing and cooling, it becomes a solid double wall steel tube, copper brazed throughout 360° of wall contact...



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Another Planning Proposal

By Julian Chase



THE Murray Bill, designed to be known as the "Full Employment Act of 1945," when and if it is enacted into law, is scheduled for discussion in public hearings before the Senate Banking and Currency Committee, beginning sometime in June. The announced purpose of this bill is to set up as a matter of national policy a program calculated to assure "full employment" through joint and coordinated action of agriculture, industry, and local, state, and federal governments. All this is to be accomplished, it is declared, within the framework of a free enterprise economy.

When estimated aggregate expenditures of all private agencies plus those of the governments do not appear to be sufficiently great to provide jobs for the estimated total number of persons available to fill them, the President is called upon to foster legislation which may encourage private enterprise to extend its efforts still further in new or augmented ventures, or to recommend increased federal expenditures for public works to an extent that, theoretically at least, should offset "a prospective deficiency in the National Budget."

The words National Budget, in this case, are used to designate the relationship between private and public expenditures which result in the making of jobs, on the one hand, and the number of potential workers, on the other.

In effect, under such a plan, the Government would guarantee jobs for all who want them. That idea is as old as feudalism. The price to be paid for its full effectiveness is sure to be, as it always has been, the sacrifice of individual freedom. The roots of the belief that there is need for such widely inclusive action as that for which the bill provides grow from the decayed psychology of the Nineteen Thirties, from the remnants of defeatist depression thinking.

However, some good may result from a thorough discussion of the plan. The most promising possibility, if history teaches us anything, is the requirement that the President shall recommend to Congress periodically specific measures for the encouragement and stimulation of private enterprise. Such recommendations should not, of course, be withheld until there is an emergency either threatened or actual. It is largely because of a woeful lack of such encouragement and stimulation that the depression of the early Thirties lingered and was revived into a following one shortly before the war boom blossomed.

An added benefit that may develop from discussion of the general plan is organization of and adequate preparation for a coordinated program of profitable public works with provision for its honest and intelligent administration. Such things cannot be done overnight. For the greatest long-run public good, they should be scientifically worked out well in advance and not turned over in a last-minute rush to pork barrel politicians.


But why a Murray Bill? With the pent-up demand for almost everything we need, with the pending post-war avalanche of new materials and new products, if we stimulate initiative and individual enterprise, cut Governmental expenses to reduce taxes, plan sanely for necessary public works, there will be jobs for all who want them.

Get Ryerson Help on Allegheny Stainless

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Are you thinking of stepping-up your post-war product or production with little or much stainless? Or is there a stainless problem in your present production? Then get Ryerson help—practical, technical service that dates from 1925 when Ryerson first stocked Allegheny Stainless. This technical service is available to small users as well as large—reaches you quickly because there are 11 conveniently located Ryerson Steel-Service plants. Ryerson stocks Allegheny Stainless exclusively as the best of the stainless steels. More than 25 types are in stock. Shipments are prompt because stocks are large and diversified. Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

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AMERICA'S World Trade Outlook

By F. L. Hopkinson

Vice-President, Willys-Overland Motors, Inc.;
and Chairman of the International Trade Relations Subcommittee, National Association of Manufacturers.

ONE has to be something more than an optimist to conclude that postwar foreign trade possibilities look good in certain important trade areas of the world. Regardless of the outcome of the present wars in Europe and Asia, the American export trade is going to suffer severe hardship in the postwar era. Nations such as England, Germany, Italy, and Japan, all will desperately require imports, not only to maintain their industrial life but to feed their populations as well. Consequently, such countries must "export or die." For only through exports can they pay for their indispensable imports. Therefore, the United States may logically anticipate very keen competition in international trade.

Latin America looks at this time and from this vantage point like a big and profitable postwar market for U. S. goods, despite the fact that British trade emissaries are right now busy in Mexico and other Latin American countries. War has not adversely affected most of these countries, although there are some exceptions. Most of them, however, have profited substantially and now have large exchange balances. The State Department's committee on Inter-American Relations has developed a high degree of mutual understanding with our Latin American neighbors—the Argentine excepted—which augurs well for future trade relations. This has been further cemented at the conference of American Foreign Ministers held recently in Mexico City.

The Argentine, needless to say, is a separate and distinct problem which may well require some form of major operation before a solution will be found. Argentina's huge agricultural production, as we all know, closely parallels our own, and tradewise she has a natural relationship with Britain and other countries of Europe.

For a look at the other side of the ledger let us move over to continental Europe where every nation has been so completely reduced economically by the ravages of two wars within one generation and their financial resources so utterly exhausted that postwar trade relations between them and the United States cannot possibly be anticipated on anything approaching a normal basis. Lend-Lease or some form of loan or subsidy arrangement must be relied on if any appreciable

This article presents the observations made by Mr. Hopkinson at a recent meeting of the International Trade Relations Subcommittee of NAM's World Trade Policy Committee.

volume of trade is to proceed. In this connection, it is important to emphasize the possibility that a continuation of Lend-Lease in its present form into postwar trading relations with Europe means that purchases will be made by the United States Government with little or no opportunity for private enterprise trade. This tendency must be strongly resisted.

The British Empire presents one of the least promising markets for postwar trade. In the first place, England will be so heavily encumbered with her external war debts that she cannot possibly have dollar exchange available for large purchases of U. S. goods. Furthermore, England's traditional relationship with those nations in her family such as Australia, which, incidentally, has never been able to export directly to the U. S. for reasons which are well known; India with its entire trade balance frozen in London, where it can be liquidated only through purchases of British goods; Egypt and South Africa with their peculiar problems in relation to the mother country—these plus the very obvious nationalistic trend within the British Empire—particularly in Australia—would seem to operate more strongly than ever toward the exclusion of American goods.

As a matter of fact, a responsible British governmental official recently asserted that not because of choice but because of dire necessity England must place herself on a strict import regulation and control basis and simultaneously work on a mutual preferential basis with her colonies and empire countries in an effort to channel all empire trade to England rather than to the United States. It would not be surprising to see the situation in the British Empire after this war become far more serious than the one created by the Ottawa Agreements Act of 1932, which operated to the serious detriment of U. S. trade abroad.

Unless something is done about it—and we must think seriously about doing something—the British Empire may be compelled to utilize every trade barrier known plus some new ones which only they are resourceful enough to invent. Consider this in the light of certain sections of Lend-Lease thinking in Washington today and you come up with a grave problem.

China, potentially one of the world's great trade markets, most certainly will have little if any dollar exchange to trade with us when the war is over. This brings again to the forefront Lend-Lease, loans and subsidies, probably all of which will proceed by direct negotiation between the respective governments. Where will American free enterprise take its place in this picture?

Russia shapes up as one of our great postwar markets—particularly for the kind of durable goods in which our manufacturers excel the world. But here again we encounter a great "if" which may very easily resolve itself into near monopolistic trading between two governments rather than upon a freer international trade basis. Many far-thinking American business men today lean toward the view that we can do a satisfactory level of profitable business with postwar Russia for many years to come by leasing to them on a royalty basis machinery, patents, technical skills and know how. The idea is intriguing and promising, but we can never lose sight of the fact that in doing business with Russia we are dealing with a state monopoly.

In looking, therefore, at the main spheres of influence over the entire globe, our postwar trade possibilities lose much of their roseate hue when you give them a cold appraisal. It is quite obvious that many obstacles must be removed.

Britain Planning Export Campaign

Large Convoys Displaying
British Products to Tour Various
Countries.

LONDON — An ambitious scheme to help Britain's postwar export trade in various parts of the world has been prepared and will be managed by an organization known as Trade Exhibitions Limited. The intention is to operate, in a number of export markets, convoys of road vehicles designed for the transport and display of British manufactured goods, supplemented by sales-promotion literature. In brief, a mobile exhibition of British products. It will be open to firms connected with any industry to participate.

It is planned to send convoys to South Africa, Russia, Canada, the United States, China, India, Burma and Australia. The first of these is due to leave for South America on October 31 next. It is estimated that it will take two years to complete each "expedition." The cost to each manufacturer who participates will depend upon the cubic space required for samples of his products.

Each convoy will be made up of 40 four-wheel-drive, panelled vans with a load capacity of 5-6 long tons; half of them equipped with Diesel engines and half with gasoline engines. Six motor caravans will provide sleeping accommodation for the drivers and attendants and four trailers will serve as offices. There will also be a mobile workshop, breakdown vehicle, mobile crane, wireless van, kitchen van and three 1000-gallon tank vehicles for water, gasoline and fuel oil, respectively. It is also intended that each convoy shall be accompanied by an aircraft, an autogiro, passenger cars and motor cycles.

The South American expedition will proceed from London to Pernambuco and travel through Brazil, northern Argentina to Bahia Blanca and thence to Buenos Aires and through Rosario to Montevideo. On the outward journey mechanics will carry out normal maintenance with the equipment of the mobile workshop, and at the end of the journey the vehicles will be overhauled and repainted for disposal locally. The goods and samples will be left with the manufacturers' local agents or returned to England, if manufacturers so desire.

Such is the scheme. Whether it will mature, whether it will secure the essential support of British manufacturers remains to be seen.

Surplus War Plants

a Knotty Problem

Defense Plant Corp. War Plants Operated by Passenger Car Manufacturers

THE following tabulation shows, as accurately as is possible from advance Defense Plant Corp. listings, plant facilities owned by DPC and operated during the war by passenger car manufacturers. Some already have been declared surplus; others will be eventually. Not included in this tabulation are war plants owned by other branches of the Government, such as the Chrysler-operated Tank Arsenal at Detroit, which is an Army Ordnance Dept. project.

	Total Plant Area (Acres)	Number of Buildings	Total Factory Floor Space (Sq Ft)
General Motors Corp.			
Buick Div.			
Flint	33.44	2	601,840
Melrose Park, Ill.	120.96	22	1,636,860
Allison Div.			
Indianapolis, Ind.	223.89	4	1,892,928
Dodge Remy Div.	19.86	8	138,608
Anderson Plant	17.5	8	214,357
Chevrolet Div.			
Saginaw	18.5	6	214,075
Tonawanda, N. Y.	33.04	1	601,000
Buffalo, N. Y.	33.33	7	390,000
Linden, N. J. Plant	188.00	8	126,234
Trenton, N. J. Plant	45.54	10	349,419
Fisher Body Div.			
Grand Blanc, Mich.	347.42	8	584,085
Memphis, Tenn.	90.56	8	707,932
Total GM	1171.84	90	7,434,148
Ford Motor Co.			
Willow Run, Mich.	1576.74	21	5,062,177
Dearborn, Mich.		5	888,720
St. Paul		1	14,400
Total Ford	1576.74	27	5,933,297
Chrysler Corp.			
Chicago	483.09	19	5,179,823
Detroit	7.09	3	32,788
Total Chrysler	490.18	22	5,212,611
Studebaker Corp.			
South Bend	379.18	9	1,888,960
Chicago	50.36	4	778,080
Total Studebaker	429.54	13	2,667,040
Nash-Kelvinator Corp.			
Lansing, Mich.	37.46	10	1,017,064
Milwaukee, Wis.	11.24	3	274,825
Total Nash	48.69	13	1,291,889
Willis-Overland Motors, Inc.	8.25	1	467,070
Packard Motor Car Co.			
Detroit		1	82,000
Toledo	79.5	13	308,727
Total Packard	79.5	14	390,727
Total for All Companies	3802.74	190	23,394,488

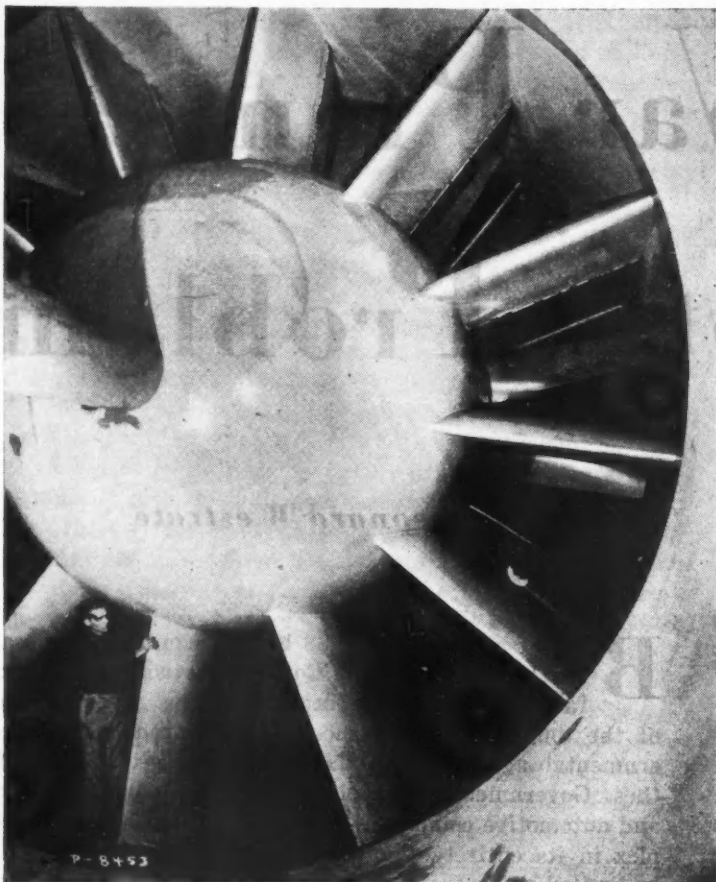
By Leonard Westrate

BUILT at a cost of over \$8 billion, equitable disposal by the Defense Plant Corp. of its war plants and facilities after they become surplus presents one of the toughest and yet most delicate problems a governmental agency and industry must face. Many of these Government-owned plants are operated by aviation and automotive companies, the scope of which is so complex in its entirety that cases cited in this article will be limited to several typical examples in one part of the automobile industry.

Here are some of the problems in specific form. Most of the buildings were built during the high-cost period when hourly rates were high and when desperate urgency required extensive overtime pay, running the labor cost even higher. Also, because steel and some other customary construction materials were critical at the time, many buildings were built with wood or other substitutes which ran material costs up. Many of the buildings were built for one specialized purpose only and may not be suitable for peacetime use without extensive and costly alterations. Many of them were designed for high-precision, mass manufacturing of munitions and simply are too elaborate and costly to maintain for a private manufacturer who has to keep his costs down to meet competition. One company reports that a building it is leasing from DPC costs \$5.50 a sq ft to build, \$1.25 a sq ft more than the estimated cost in 1941, and \$2.00 more than in 1937. In addition, it contains many features not required for peacetime goods, so that the company itself could have put up a building suitable for its needs in 1941 for about \$3.75 per sq ft.

In view of these high original costs, there has been some skepticism among leaders in the automobile industry over the possibility of buying at a fair price any buildings they may be able to use. However, investigation reveals that DPC is realistic about its problem and that while there apparently will be no windfalls if that agency can help it, sales will be made at a reasonable figure.

The general policy to be followed by DPC will hold first that none of its holdings shall be sold at a price that will give the buyer an unfair competitive advantage
(Turn to page 88, please)



Closeup of the tandem fan installation. Each of the two-stage fans consists of 12 stationary prerotation vanes and 16 blades.

THE Southern California Cooperative Wind Tunnel, to be placed in operation the latter part of May at Pasadena, is a \$2,500,000 project financed and owned by four Southern California aircraft companies—Consolidated Vultee (1/3), Douglas (1/3), Lockheed (1/6), and North American (1/6)—and is being operated by the California Institute of Technology under the direction of Dr. Clark B. Millikan, who also is acting director of the Guggenheim Aeronautical Laboratory. It was originally conceived as a design instrument for use by airframe manufacturers in carrying out the aerodynamic development of current and new aircraft. The design of the tunnel was jointly supported by the cooperating Southern California companies and the Curtiss-Wright Corp., which is constructing an essentially identical wind tunnel at Buffalo, N. Y.

It is a variable-pressure, variable-density, high-speed tunnel with a working section having cross-sectional dimensions of 8½ by 12 ft. Pressure can be varied between ¼ and 4 atmospheres. With 12,000 hp available to produce the airflow, velocities up to 700 mph can be attained with the tunnel evacuated, and scales equivalent to that of a 40- to 45-ft span model can be reached with the tunnel at high pressure. This variation in pressure required that the tunnel be airtight and to accomplish this all joints in the wind duct

Southern California Cooperative

were sealed by electric arc welding them. Some 1500 tons of steel plate were used in its construction.

Decompression Sphere

The working section is surrounded by a steel sphere 31½ ft in diameter that is closed by a massive 18-ft diameter steel door and two gate valves which cut across the air-flow circuit ahead, and downstream, of the working section itself. The design and hydraulic operation of the gates and door permit the working section to be hermetically sealed. When the tunnel is operated under either pressure or vacuum conditions, and model adjustments of modifications are to be made, the sphere may be isolated from the tunnel, brought to the selected pressure, and entered by operating personnel without loss of pressure or vacuum in the remaining 90 per cent of the tunnel. A complex system of valves, hydraulic jacks and controls permits these operations to be accomplished in several minutes as compared with the several hours that would be required without this equipment.

DATA

Tunnel size over-all	179 ft over-all length, and 72½ ft maximum width
Working section	12 ft wide by 8½ ft high
Maximum diameter	31½ ft diam
Contraction ratio	8 to 1
Maximum pressure	4 atmospheres
Vacuum	¼ atmosphere
Size of fan	21 ft, 9½ in. diam
Number of fans	2
Number of blades in each fan	16
Fan hub diameter	12 ft
Size of Nacelle for fan hub and bearing	12 ft diameter by 50 ft long
Drive shaft	16-in. OD hollow steel; ½-in. wall
Main drive power	12,000 hp, maximum
Main drive speed	595 rpm, maximum
Air speed	More than 700 mph
Model power supply	400 hp over range of 150 to 450 cycles. Voltage available — up to 600 volts
Weighing system capacity (maximum)	Lift + 30,000 lb to — 15,000 lb. Drag + 5,000 lb to — 2,500 lb. Cross-wind force + 5,000 lb to — 5,000 lb. Pitching moment + 10,000 ft. lb to — 10,000 ft. lb. Yawing moment + 10,000 ft. lb to — 10,000 ft. lb. Rolling moment + 10,000 ft. lb to — 10,000 ft. lb.

Wind Tunnel

Three huge steel tables or carts which carry models onto the sphere on steel rails are provided. Each has a different type of model support and can be rolled into or out of the sphere when the main door is opened.

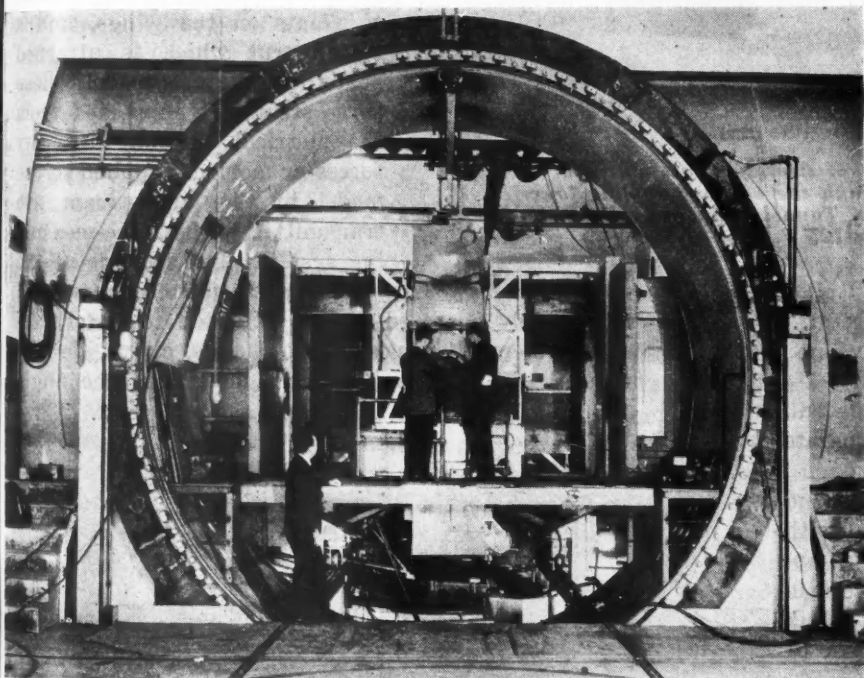
The fan is designed to operate at the highest pos-

sible efficiency over the entire range of tunnel pressure and to be able to absorb the maximum output of 12,000 hp. The design resulting from these requirements is an unusually flexible fan arrangement, operating at a maximum of 595 rpm and consisting of two identical stages and a set of flow straightening vanes, located downstream of the second corner of the wind tunnel. Diameter of the tunnel in that region is 21 ft, 10 in. and the hub diameter of the fan is 12 ft.

Each fan stage consists of a set of 12 stationary prerotation vanes and a set of 16 fan blades with detachable coupling located between the two fan hubs, making it possible to use either the first stage, alone, or both stages. The prerotation vanes are equipped with adjustable 30 per cent trailing edge flaps and the

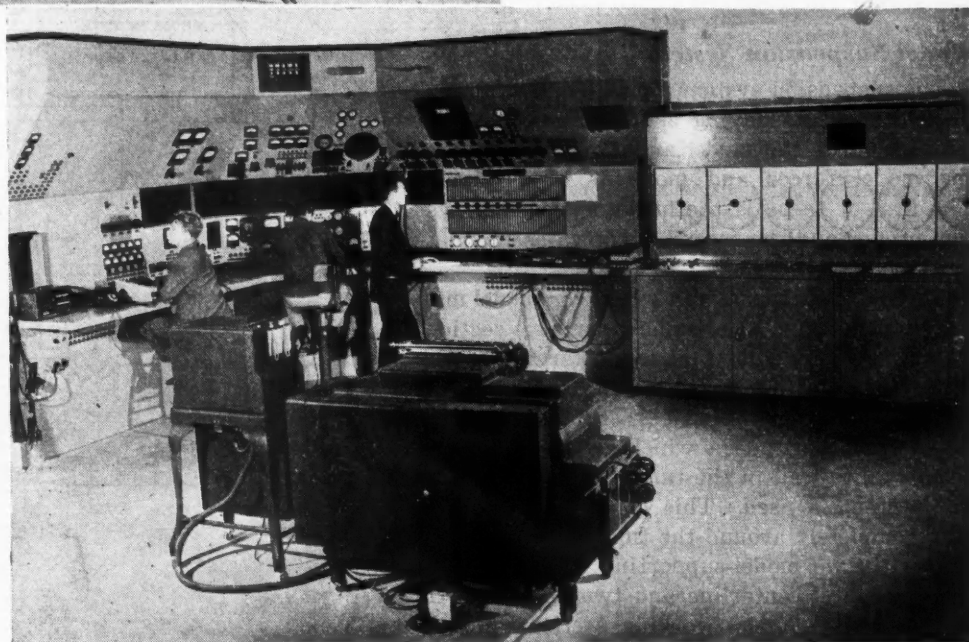
pitch of the fan blades can also be adjusted; both of these adjustments can be made by remote control. This control is arranged in such a manner that it is possible to change all of the flap angles and blade angles simultaneously by means of a master push button, or to carry out the change separately for each of five special combinations of units.

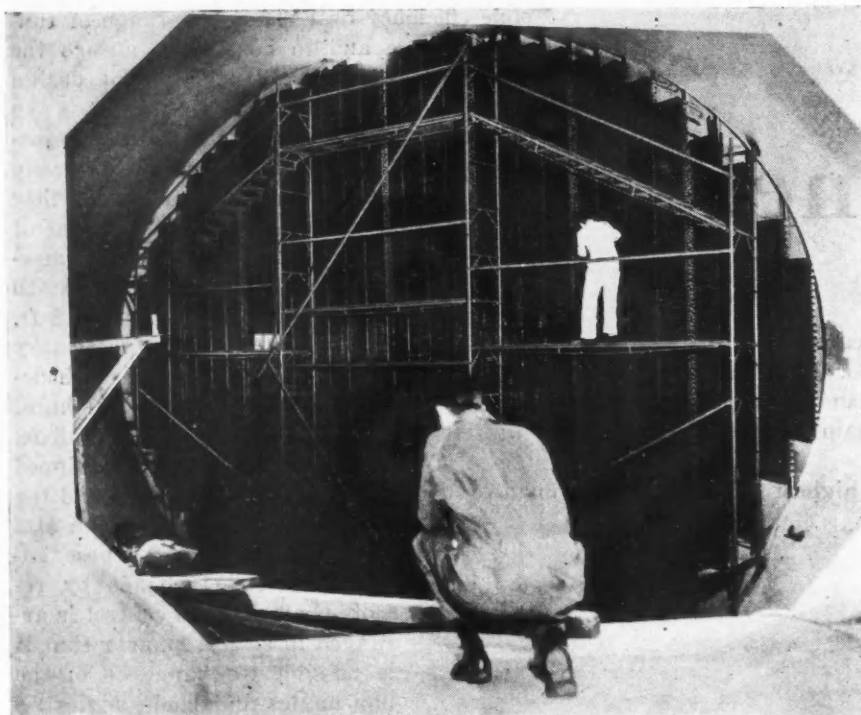
It is envisaged that the master push button will be used for all adjustments during a run while the separate controls will be needed whenever the tunnel pressure or speed is appreciably changed. In the region of high pressures (about $1\frac{1}{2}$ to 4 atmospheres), one half (eight) of the blades of the first stage will be used. The other half of the



(Above) View of working section with model table.

(Right) Master control room. Forces and moments are indicated on the dials at the right, and on the light bank panels, center. Readings are recorded automatically on the specially-designed IBM machines in the foreground.





Cooling radiator installed at corner of steel duct just upstream of the throat. Water is circulated through the coil and cooling tower at rate of 3600 gallons per minute. Tunnel temperature is maintained below 125 F.

blades of that stage and all the blades of the de-clutched second stage will be set to give no thrust. In the intermediate pressure range (about $1\frac{1}{2}$ to $\frac{3}{4}$ atmospheres), all blades of the first stage will be used, while both stages will have to operate at the lowest tunnel pressures.

At the proper combination of blade pitch and flap angles, the airflow will leave the fan with approximately axial direction; i.e., without appreciable rotation. Any small rotation left in the flow is removed by means of a set of six straightening vanes located just downstream of the second fan stage.

Model Suspension System

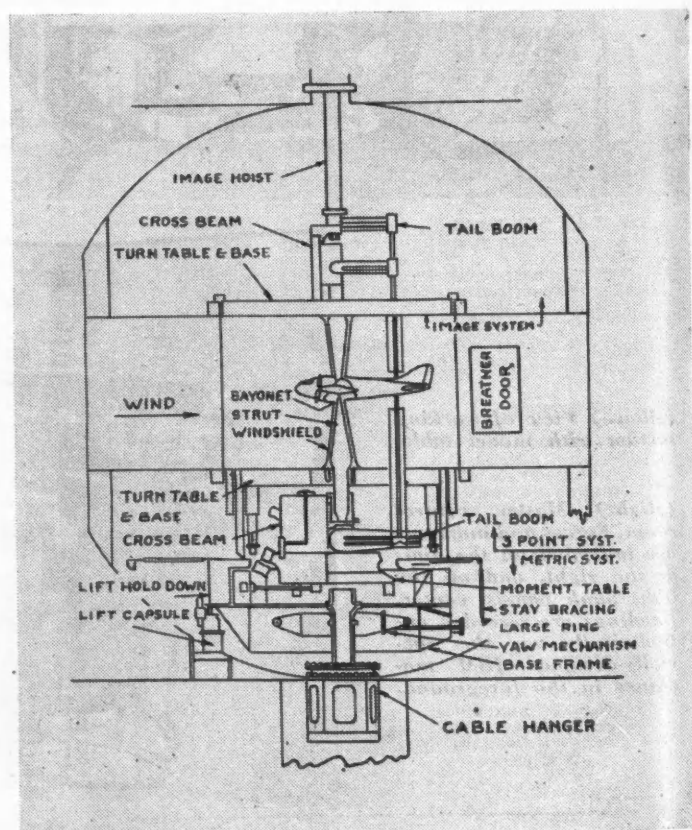
The suspension system consists of two fundamental elements having as their objective the supporting of the model and the measuring of the model forces and moments, respectively. The first of these is the model suspension system proper and the second is known as the metrical system.

There are three ways in which the model may be supported in the tunnel working section. The first arrangement is for determining the properties of wing sections, wing sections with flaps or other control devices, stub wing nacelle models or other models which can be supported from wall to wall in the tunnel, a ring-supporting system is used. This consists of a large ring completely around the tunnel working section with two model-supporting face plates on the horizontal centerline and two on the vertical centerline of the working section. Models

can be supported on either of these pairs of face plates and can be rotated by remotely-controlled motors in the ring frame. The ring frame does not touch the working section but is entirely supported from the metrical system, thus any forces applied to the model are transmitted directly through the ring frame to the force measuring system.

The second model-supporting system is that most commonly associated with wind tunnels—the three-point system. In this, a scale-sized model of a complete airplane is supported by means of two vertical model support arms (trunnion arms) attached to points on the wings, and a third strut which is attached near the tail of the model. These three struts are supported from the metrical system, thus any forces or moments applied to the model by the air stream are transmitted to the force-measuring system. The attitude of the model in the tunnel is controlled

by remotely operated motors attached to the three-point system. It is possible to change, over wide limits, both the pitch angle of the model and the angle



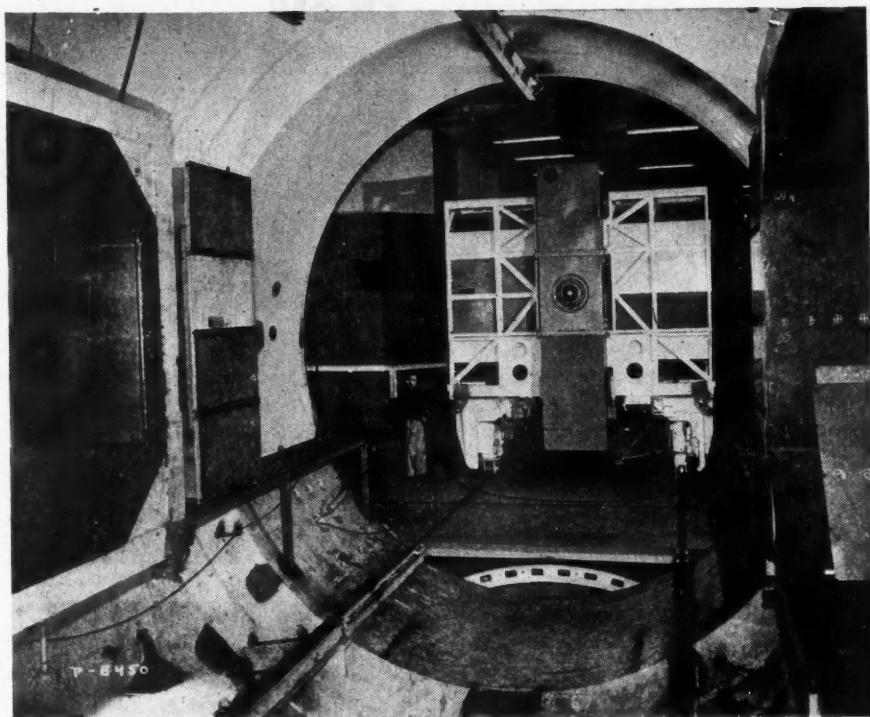
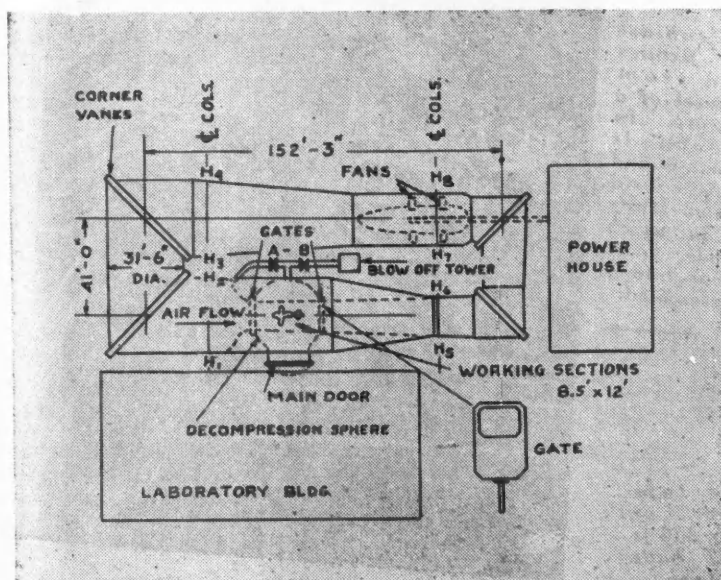
of yaw. These model motions are controllable from the console and the model position is indicated on the control console.

In order that the air forces on the trunnion arms and tail strut may be held to a minimum, all three units have windshields covering a large proportion of their length. The main trunnion arms are covered by a streamline windshield which is automatically kept lined up with the windstream, even when the model is operated at angles of yaw. The tail strut windshield changes with the proper vertical and horizontal motion as the tail is moved up and down to set the angle of attack of the model.

The third type of model support is known as the NACA strut support system. In this, the tail strut is removed and the main trunnion arms are replaced by two other arms each having a double strut at the top. The model is connected to these systems and, since the rear struts are remotely adjustable, the model may be adjusted in angle of attack from the control room. In general, with this system in use, the model will not be rotated in yaw. For small or lightly loaded models, it is possible to put one NACA trunnion at the center of the working section and support the model on a single tripod system. These arms are also attached to the metrical or force-measuring system and are windshilded to reduce wind loads on the supporting arms.

(Left) Suspension and measuring systems.

(Below) Plan drawing of wind tunnel.



Rolling a model table into the tunnel working section. In the foreground can be seen the throat entrance and exit (left).

In order to determine the tare drag of the model supporting system and the effect of the supporting system on the airflow around the model, a so-called image system is used. This consists of an inverted frame hanging above the ceiling of the working section, upon which are attached main and tail strut windshields which are inverted duplicates of those for the three-point system. By the use of this image system, flow symmetry about the model may be obtained and the effect of one asymmetrical set of supports can be determined. This image system is attached to an hydraulic ram passing through the top of the working region sphere and may be lowered into the working section as needed. The image system frame may also be used to support various flow measuring and calibrating devices either instead of, or in conjunction with, one of the regular three-point systems.

Force Indicating System

The force-indicating system is a new application of the principles used in the Southwark-Tate-Emery testing machines, which are manufactured by the Baldwin Locomotive Works in collaboration with the A. H. Emery Co. The Tate-Emery system is a method of hydraulic weighing of forces on the model in the tunnel and of remote indication in the control room. This system is composed of two elements—the weighing system and the indicating system.

The weighing system consists essentially of nine new-type Emery capsules which are located in the suspension system. The Emery capsule is primarily a rigid cylinder and

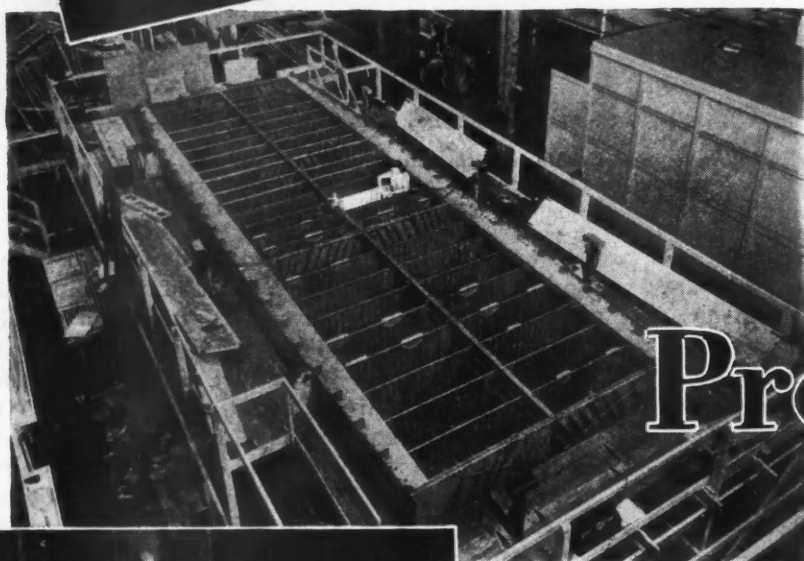
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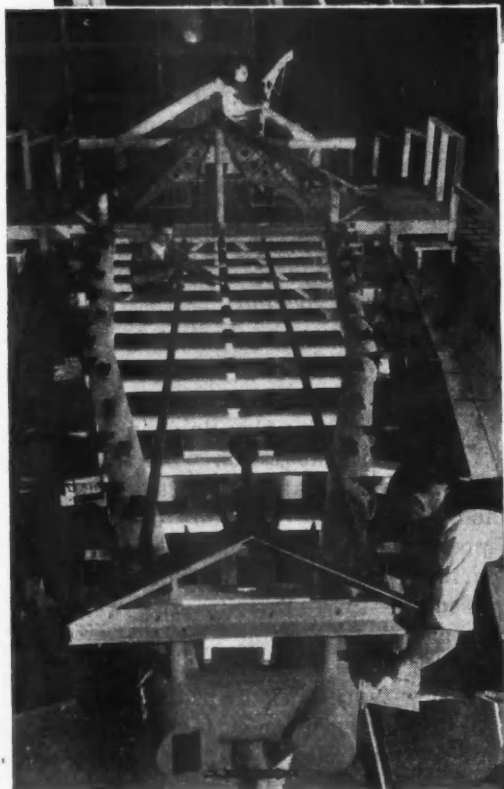
Fitting de-icer lines on the outer wing front spar. This fixture is 55.83 ft long. Steel pipes are 6 in. and 8 in. in diameter.



Main tank section, with a capacity of more than a tank car of gasoline. Bulkheads are built in arbor fixture, then assembled upside down, complete with skin, before being rolled over into position shown here.



Production F



Some sub-assembly fixtures viewed from fourth level of a hull fixture. In foreground is tank section and in background the two-story arbors in which bulkheads, floors and floor frames are assembled.



Aft bottom panels, each of which is 20 ft long, are built upside down.





↑ *Three hull fixtures nearly completed. Each fixture has five working levels, is 130 ft long, 29.33 ft high and 29.5 ft wide. Men in the picture give some idea of the size of these hull fixtures.*

Closeup of the center hull fixture, looking up and aft. Inverted V in foreground is keel locator. Towering above are the chine locators, contour boards and at extreme top center, wing and stabilizer locators.

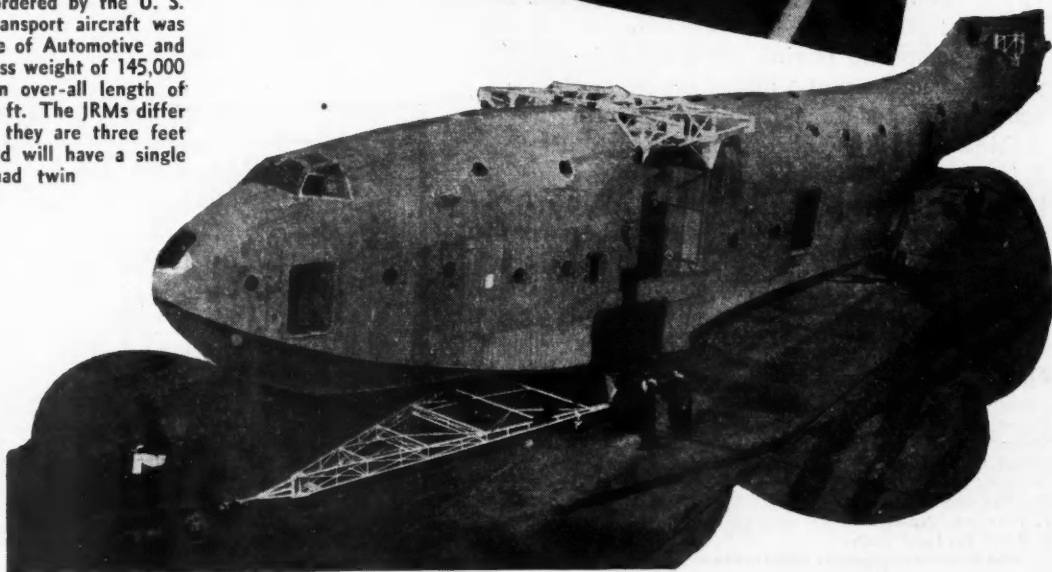


Fixtures

for JRM Mars

The pictures on these two pages show the tremendous size of the largest fixtures that have been erected at The Glenn L. Martin plant near Baltimore to build sub-assemblies for JRM Mars flying boats, 20 of which have been ordered by the U. S. Navy. A description of this transport aircraft was given in the April 15, 1944 issue of *Automotive and Aviation Industries*. It has a gross weight of 145,000 lb., a wing span of 200 ft., an over-all length of 120.25 ft., and a height of 44.58 ft. The JRM's differ from the original Mars in that they are three feet longer, carry a heavier load, and will have a single rudder. The original Mars had twin rudders.

Moving a JRM 10-ton hull onto the apron. More than half of the 32 ports and 17 hatches are in view. The center cargo door is 8 by 7½ ft.



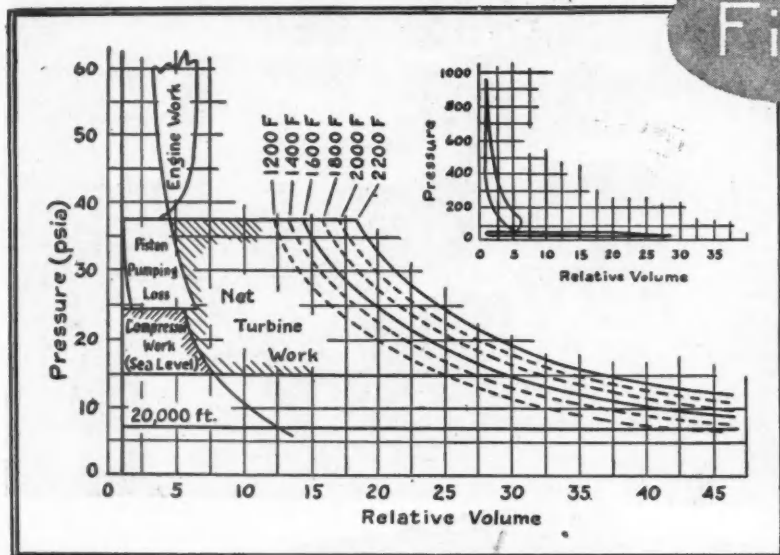


Fig. 1—Pressure-volume diagram for compound engine

By C. F. Bachle

Vice President in Charge of Research
Continental Aviation & Engineering Corp.

Possibilities of Turbine Compounding

IN EXAMINING the present-day aircraft power plant position for possibilities of reducing fuel consumption, the large waste of energy in the exhaust gas, which results from insufficient expansion ratio, is conspicuous. It is the intention here to consider combination of the turbine with a piston internal-combustion engine as a means of utilizing the exhaust energy. The common use of the turbo-supercharger to supply aircraft engines in flight with intake air at sea-level pressure, and thus maintain sea-level power at altitude, is an example of what can be done in this direction. However, even under this condition, the full power capabilities of the turbine are not utilized since the exhaust gas has excess energy over that required for air compression. This excess energy can be used to provide increased power and reduced fuel consumption.

The compound engine referred to in this paper is composed of a piston engine mechanically connected to a turbine and with the turbine receiving the engine exhaust. Fig. 1 is a pressure-volume diagram of an internal-combustion engine with additions

made to represent the turbine work when operating from exhaust-gas energy. This energy is made available through a pressure differential which entails losses in the engine. The same result might be obtained by expanding the exhaust in a second cylinder but this method of utilizing the exhaust gas is outside the scope of this paper.

The temperature of the exhaust gas received by the turbine is represented by various expansion lines but full advantage of the energy possibilities are impractical because of present design and metallurgical limitations. In any case, 1600F is the present practical limit, while 1900F is a distinct possibility in the immediate future. In cases where it is necessary to control exhaust-gas temperature it is entirely practical to provide a heat exchanger before the turbine and

This article was prepared from the paper of the same title presented at the War Engineering-Annual Meeting of the Society of Automotive Engineers, Jan. 8-12, 1945, at Detroit.

Fig. 2—Available exhaust power

Point "A"—Represents cruise at 23 psi differential
Point "B"—Represents take-off at 23 psi differential
Point "C"—Is for same P_e/P_a as in "A"
Point "D"—Is with fixed area nozzle determined by "A"
Curves are based on:
1. 7 lb per bhp-hr
2. 0.066 fuel-air ratio
3. 1600 F exhaust-gas temperature

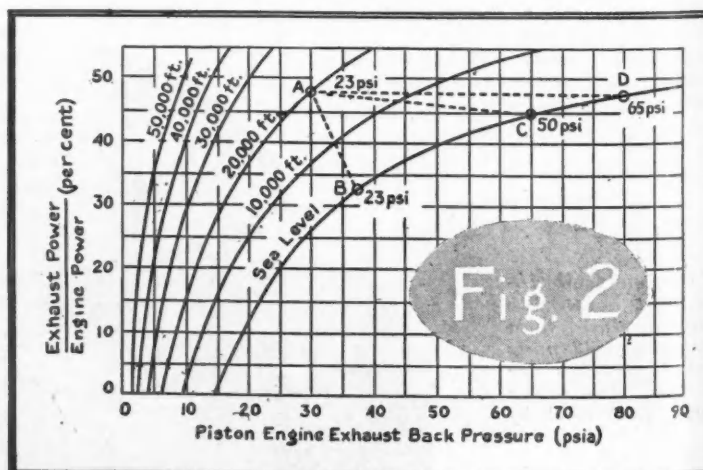


Fig. 3—Compound engine thermal efficiency

Point "A"—Cruise with 23 psi differential
 Point "B"—Take-off with 23 psi differential
 Point "C"—Take-off with same pressure ratio as in "A"
 Curves are based on:
 1. 0.066 fuel-air ratio
 2. 70 per cent turbine efficiency
 3. 73 per cent compressor efficiency
 4. 1600 F exhaust-gas temperature

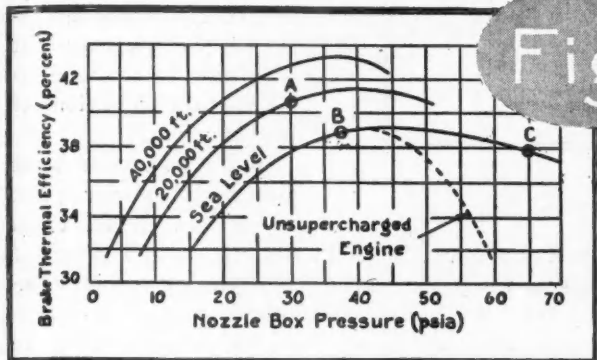


Fig. 3

If a pressure differential of 23 psi is selected, then the exhaust power available in the exhaust is 47 per cent of the engine output at 20,000 ft, and at sea level with the same differential, the exhaust power available is about 33 per cent of the piston engine output. These figures do not make allowance for the loss in output due to the effects of exhaust back pressure on the piston engine. Some of the exhaust energy must be utilized, as shown in Fig. 1, to supply the losses in the engine due to increased pumping; and, in cases where there is a supercharger, to supply increased supercharger power.

Fig. 3 is an estimate of the thermal efficiency which might be expected from a compound engine under various conditions of operation. The results are for minimum consumption mixtures and cruising conditions generally. This implies a low engine speed and high output to obtain the best mechanical efficiency, and it is assumed that enough supercharger ratio and aftercooling is provided to maintain constant engine imep at all altitudes. The turbine efficiency and compressor efficiency assumptions of 70 to 73 per cent, respectively, are considered conservative.

The results so far have been with an assumed turbin efficiency of 70 per cent. In the light of present knowledge, this is considerably under the maximum possible for an impulse turbine. Fig. 4, which shows typical turbine efficiency characteristics, is plotted with velocity ratio as the abscissa. The velocity ratio is an important concept in turbine performance and in applying the turbine to the piston engine. The velocity ratio is defined as follows:

g with Piston Engine

use the energy for airplane-wing heating or cabin heating.

The total exhaust power available without regard for the losses which occur in the engine is shown in Fig. 2. There are several factors which will determine how much of this exhaust energy may be used, the chief of which is the allowable stress in the exhaust pipe connecting the engine cylinders to the turbine. With careful shrouding to conduct cold air over the heated surfaces, a metal-to-exhaust-gas temperature differential of about 300F can be expected which might bring the exhaust pipe metal to about 1600F. At this temperature, the metal has ample strength to permit fairly high stress from pressure differential; however, expansion joints must be used to prevent overstress from thermal expansion. Although expansion joints are difficult to make leak tight and durable, fairly satisfactory life has been obtained in present aircraft turbo-supercharger systems which operate with a pressure differential of about 18 psi. Improvements of these expansion joints are in prospect which it is believed will raise the permissible pressure differential to about 30 psi without any increase in weight.

Fig. 4—Turbine characteristics

Point "A"—Cruise condition at 20,000 ft—Turbine-tip speed 900 fps
 Point "B"—Take-off condition at sea level—Turbine-tip speed 1500 fps
 Point "C"—Take-off condition at sea level with same P_e/P_a as in "A"
 Point "D"—Take-off condition at sea level with fixed-area nozzle determined by "A"
 Points "B," "C" & "D" are with cruise at 0.6 take-off speed
 Points "B," "C" & "D" are with cruise at 0.7 take-off speed

Fig. 4

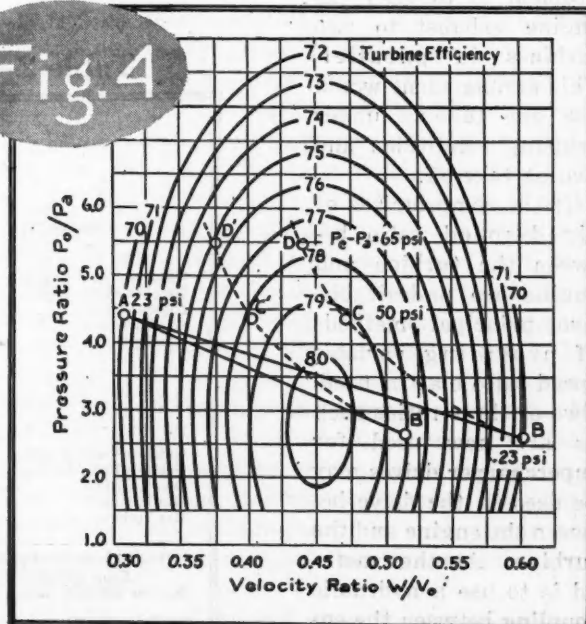


Table 1—Engine Performance Comparison

Engine Type	Thermal Efficiency at Cruise	Expansion Ratio	Temperature		Engine Efficiency	Cruise at Per Cent Take-Off Power	Ratio of Power Plant Weight to Power at	
			Peak	Exhaust			Cruise	Take-Off
Gasoline Piston Engine (1)	31	6.5:1	4500	1600	71	50	3.4	1.7
Gasoline Piston Engine, Compound	40	28:1	4500	1300	78	50	3.0	1.5
Diesel Engine	40	12:1	4500	1000	82	65	3.9	2.5
Gas Turbine for Jet Propulsion	16	4.5:1	1400	900	58	85	0.51	
Gas Turbine with Propeller	16	4.5:1	1400	900	56	85	1.1	0.9
High Temperature Gas Turbine (2)	38	4:1	1800	1100	67	85	1.3	1.1
Steam Turbine (2)	34	1450:1	1000	90	84			

(1) With turbosupercharger. (2) With regeneration. (3) Overall electric power generation plant.

$$R = \frac{W}{V_o} = \frac{\text{Velocity at the pitch line of turbine buckets, in fps}}{\text{Absolute velocity of gas leaving nozzle box, in fps}}$$

The narrow turbine speed range over which good efficiencies may be obtained is a limitation which is most difficult to reconcile with engine performance. For maximum cruise efficiency, the engine and propeller speed is commonly chosen at 0.6 take-off speed. Therefore, for the best efficiency over the speed range from cruise to take-off, a variable ratio drive between the turbine and the engine should be provided.

In addition to the speed problem, there is a problem of nozzle area which should vary in proportion to the power output of the engine. The nozzle is like an orifice so that the pressure drop varies sharply as the exhaust flow changes. The simplest method of pressure control is by means of a waste gate which passes some of the exhaust gas to the atmosphere without passing through the turbine; however, this is wasteful of energy. Another method is to use a variable area nozzle. It is not difficult to design a turbine having a two-section nozzle box, one section of which may be closed off during low output operation; but there is some sacrifice in efficiency when operating on one nozzle box only. A still further method of handling the nozzle area problem is to feed the engine exhaust to two turbines in parallel. This arrangement would use one turbine under cruising conditions and two at take-off.

If the compromises of fixed-speed ratio between the turbine and engine are undesirable, two principal methods of providing variable speed ratio may be used. Two or three ratios such as are now used for supercharger drives may be used in the drive between the engine and the turbine. Another method is to use a hydraulic coupling between the en-

gine crankshaft and the turbine. This device has the additional advantage of isolating the turbine from crankshaft vibration but has the disadvantage of increasing oil heat loss. In most cases, however, excessive hydraulic coupling heat loss can be avoided by careful selection of ratios.

A review of some prominent power plant types now in use or in

prospect is given in Table I and is shown as a means of evaluating the performance of the engine-turbine compound against other types of power plants. It is evident that the steam power plant and Diesel engine are near the ultimate for their type while the present gas turbine leaves room for development to give better utilization of the cycle potentialities. The weight power ratios are based on the power plant cruising under its most economical condition and do not evaluate aircraft operating factors. The power plant weights are based on an installed engine with accessories such as heat exchangers, exhaust systems and propellers. The gas turbine data is based on rough estimates since there is no published data on the weights of aircraft versions of this type of power plant. From this it is clear that the turbines are about one-third the weight of the piston engines when compared on a cruising power basis; and, if it were not for the poor fuel consumption, the gas turbine probably would have replaced the internal-combustion engine in recent years.

Table 2 gives the results of power plant thrust efficiencies when using the various type power plants at 300 mph and at 550 mph. The comparison of 300 and 550 mph is based on aircraft of equal drag at the speeds indicated.

Table 2—Aircraft Engine Combined Performance

Engine Type	Type of Propulsion	Efficiency		300 Mile Trip at 300 mph (2)		3000 Mile Trip at 300 mph (2)	
		Propulsion	Thrust	Fuel Cons. (lb/trip/thp)	Total Weight (1) (lb/trip/thp)	Fuel Cons. (lb/trip/thp)	Total Weight (1) (lb/trip/thp)
Gasoline Piston Engine	Propeller	83	25.7	0.64	4.7	6.4	10.5
Gasoline Piston Engine, Compound	Propeller	83	33.2	0.50	4.1	5.0	8.6
Diesel Engine	Propeller	83	33.2	0.50	5.2	5.0	9.7
Gas Turbine	Jet	40	6.4	2.59	3.3	25.9	26.5
Gas Turbine	Propeller	83	13.3	1.24	2.8	12.4	14.0
300 Mile Trip at 550 mph (2)							
Gasoline Piston Engine	Propeller	52	16.1	0.30	6.9	3.0	9.5
Gasoline Piston Engine, Compound	Propeller	52	20.8	0.24	5.9	2.4	8.1
Diesel Engine	Propeller	52	20.8	0.24	7.8	2.4	9.9
Gas Turbine	Jet	64	10.3	0.48	0.9	4.8	5.2
Gas Turbine	Propeller	52	8.3	0.59	3.1	5.9	8.4

(1) Weight of power plant plus weight of fuel.
(2) Equal aeroplane drag assumed for both speeds. This means that the 550-mph plane requires 83 per cent more power than the 300-mph plane.

Prewar convertible car equipped
with automatic folding top



By A. P. Sedorff

President,
Motor State Products Co.

The Status of the

Postwar Convertible Car

THERE is a lot of evidence that when automobile production is resumed the demand for convertible cars will assume larger proportions than was apparent in pre-war days. An analysis of this evidence requires a review of earlier conditions, and a description of the developments that have taken place, or are on the way, to alter the conditions.

At the time automobile production was discontinued the purchasers of open cars comprised about two per cent of the total passenger car buyers. This two per cent consisted of people who placed a high value on the convertible's jaunty lines, tailored appearance, roadability, and low wind resistance. To these buyers the added cost (\$250 to \$350 more than a closed car) meant little compared to the pride of ownership and the "open-road" thrill. Ninety-eight per cent of the potential buyers assumed a more practical attitude. They hesitated to buy the open job because of certain prejudices, most of them entirely justified, especially the following:

1. The raising and lowering of the top was inconvenient and time-consuming. Even the "one-man" top required very careful handling to keep from springing the bows and to assure neat folding of the fabric.

2. The deterioration of the top fabric usually occurred so rapidly that the convertible lost its new-car appearance much too early. Tops seldom lasted for the life of the car. As a result, the trade-in price was out of line with that of other body types in the same price class.

3. Draftiness was much in evidence in spite of the use of countless snap fasteners.

4. Visibility was often sacrificed for appearance, or to accommodate the top-folding linkage and bows. The size of rear windows had to be kept at a minimum. There were too many blind spots.

5. The interior appearance was in contrast to the tailored exterior lines because of exposed linkage. Linkage collected dust and was inclined to be noisy.

6. Seat covers, chosen for their waterproof quality, retained both heat and cold to an undesirable degree.

7. The convertible lost some of its streamlined appearance when the top was raised because the top was usually incorporated as an accessory to a cut-down coupe, rather than designed integrally with the body.

It will be readily apparent that none of these objections (with the possible exception of item 6) was based on the qualities of the convertible as an open car. In each case the prejudices were based on features that were revealed when the time came to convert the open car into a closed car. To arrive at any conclusion as to the possibility of an increased ratio in the postwar demand for convertible cars, it is necessary to consider the methods of overcoming the prewar objections. Let's consider them one by one.

1. The introduction of the push button top in 1938 eliminated to a remarkable degree the objections to inconvenience in raising and lowering the top. Not only were vacuum, electrical, and hydraulic devices installed for the purpose of providing the necessary power, but bow and linkage action was designed to automatically engage the fabric in such a way as to assure neat folding without attention on the part of the automobile operator.

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Thermal Stability Method of Ev Engine Oils an

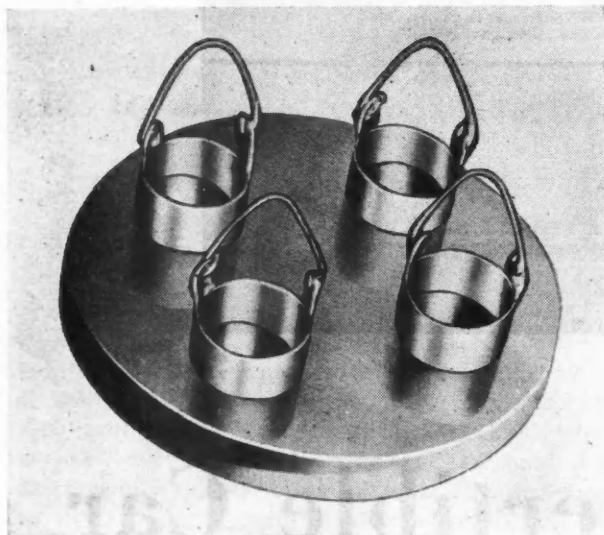


Fig. 1—Steel plate with four rings for thermal stability test.

K. K. PAPOK of the Research Institute of the Soviet Red Air Fleet has described a new method of evaluating the piston ring sticking tendencies of aircraft engine oils that is a development from a report by McNicholl, Williams and Lamarque (*Journal of the Institute of Petroleum*, vol. 25, No. 193, 1939). His method involves the correlation of a factor he calls, "Thermal Stability of an Oil," and ring sticking conditions in the actual engine. The thermal stability value of a given oil is defined as the number of minutes required to transform the oil into an elastic film, at a given temperature, such that a force of one kg will lift a metal ring away from the surface of the film. The slower the properties of

an oil change under the action of heat, the higher the thermal stability and the less the tendency toward ring sticking with the use of this oil.

In the introduction of the report it is pointed out not only do the formation of carbon and other deposits depend greatly upon the qualities of various oils, but also upon where the deposits occur and under what conditions. The processes of carbon formation in a combustion chamber differ radically from those at the piston rings. In the first case the properties of the oil are modified at high temperatures of 2000 C to 2500 C, the change proceeding rapidly in an atmosphere rich in oxygen. Moreover, the carbonization of the oil in the combustion chamber is influenced by the properties of the fuel, and carbon deposit from the oil always includes some from the fuel. But in the

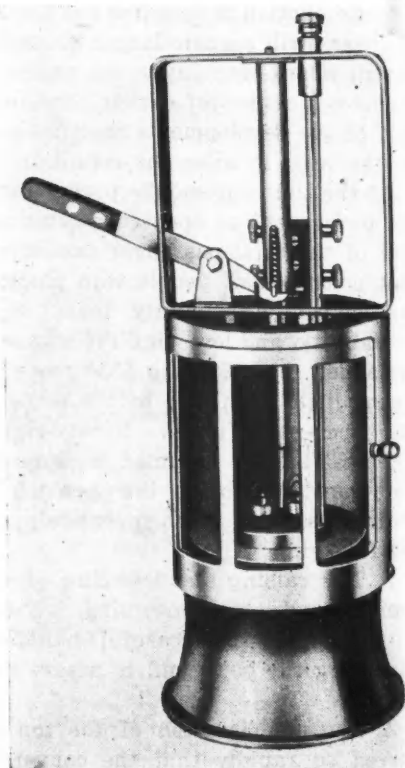


Fig. 2—Enclosed apparatus for heating plate and rings of Fig. 1.

Table I. Effect of antioxidants on the thermal stability of "mixed" oil

	"Mixed" oil containing					
	No additive	1% Santolube 365	1% Aerolube RS-14	1% Aerolube RS-13	3% Alex 425	0.5% tributyl phosphite
Thermal stability in minutes at 240 C.....	60	..	..	70	50	..
250 C.....	..	45	47	..	..	60
260 C.....	24	33	27	40	29	32
280 C.....	11	15	8	20	7	15

f Evaluating

S and Relation to Piston Ring Sticking

piston ring zone, where the oil is exposed to temperatures hardly exceeding 300 C and where the air is poorer in oxygen, the processes develop more slowly and the modification of the oil is less affected by other factors.

The apparatus for the Papok test consists of three essential parts: (1) A steel plate (Fig. 1), 70 mm in diameter and 10 mm thick, with four metal rings having inner and outer diameters of 14 and 16 mm, respectively; (2) a heating apparatus (Fig. 2) ensuring uniform heating of the plate and rings, and capable of maintaining the plate continuously at a given constant temperature; and (3) a balance with a scale and sliding weight (Fig. 3) to measure the force required to detach each ring individually from the plate.

The plate, with the four rings symmetrically disposed on it, is placed in the heating apparatus. The

temperature of the plate is shown by a thermometer inserted in a recess in the plate, filled with a metal melting at the test temperature. When the required temperature has been attained, 0.1 mg of the test oil is poured by a pipette into each ring and the time is recorded by a stop-watch. The whole set-up is then kept at the required temperature until the oil has formed a dark film. After recording the time required for the formation of this film, the plate with the rings is carefully removed from the heating apparatus and left to cool at room temperature for one hour. The balance is then used to detach the rings from the plate, thus measuring the force in kilograms required. Finally, the mean of the values for the four

Table II. *Effect of antioxidants on the thermal stability of Luboil 34A/32X*

	Luboil 34A/32X containing				
	No additive	1% Santolube 365	1% Aerolube RS-14	1% Aerolube RS-13	0.5% tributyl phosphite
Thermal stability in minutes at 260 C.....	27	54	57	40	70
280 C.....	9	32	30	24	36
290 C.....	..	15	13	14	..
300 C.....	5	..	..	..	8

Fig. 3—*Type of balance used in determining the thermal stability values of various oils.*

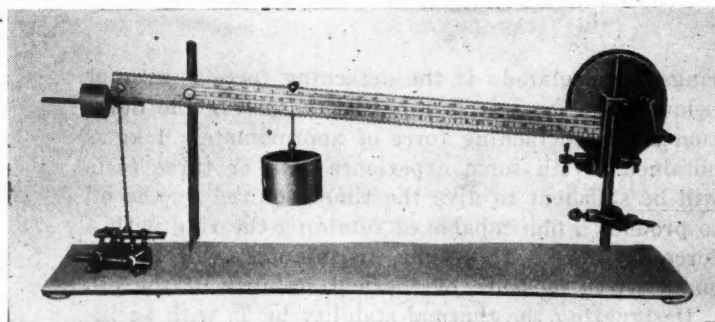


Table III. *Variation in thermal stability according to percentage of tributyl phosphite*

	Aircraft engine oil SO containing tributyl phosphite, in %				
	0	0.1	0.3	0.5	1.0
Viscosity/Engler at 50 C.....	22.7	21.8	21.4	20.9	19.9
100 C.....	3.10	3.06	3.0	2.96	2.82
Thermal stability in minutes at 240 C.....	90	..	92	110	..
250 C.....	54	64	..	..	..
260 C.....	29	44	55	65	64
280 C.....	14	16	17	22	20

Table IV. *Relationship between the thermal stability bench tests of various oils and the actual sticking of piston rings in M-11 engine flight tests.*

Oil	Total duration of test in hours	Thermal stability in minutes at			State of piston rings at or before end of test
		240 C	260 C	280 C	
Castrol-90.....	50	14	9	5	Pistons 1 and 3, top rings stuck
K-6.....	50	22	13	5	Pistons 1 and 2, all rings stuck
K-7.....	107	32	12	5	Pistons 1 and 2, top rings stuck; piston 3, two top rings stiff; piston 5, two top rings stuck
Aerol-10.....	100	38	12	9	Piston 1, top ring stiff; pistons 2 and 5, top ring stuck
Oil V.....	400	42	14	6	After 30 hr—piston 4, top ring stiff. After 70 hr—pistons 1 and 4, two top rings stuck; piston 3, 2nd ring stuck After 100 hr—piston 1, top ring stuck; piston 3, top ring stiff
Oil SO.....	100	90	25	14	Good
Aerol-3.....	106	—	31	12	Good

rings is calculated. If the detaching force is over or below 1 kg, the test is repeated, adjusting the duration until a detaching force of approximately 1 kg is obtained. With some experience, two or three tests will be sufficient to give the time required by the oil to produce a film capable of retaining the ring with a force of 1 kg. This time, in minutes, will be the quantitative measure of thermal stability of the oil.

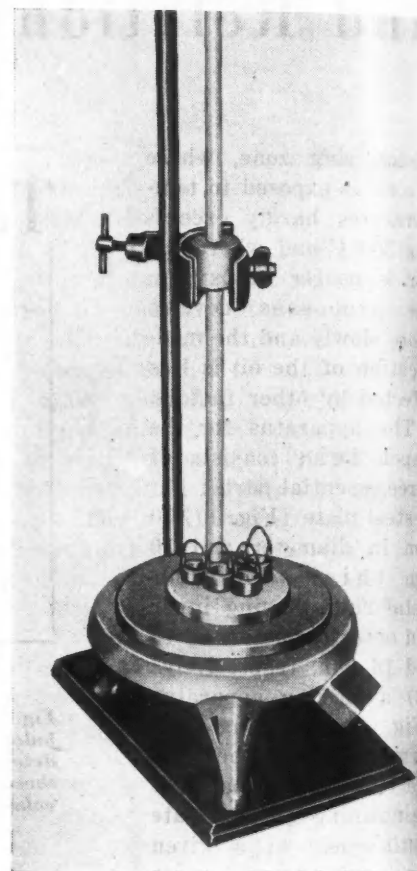
Designating the thermal stability by T, with an index showing the test temperature as, $T_{280} - 20$ min, means that the thermal stability of the oil tested at 280 C is 20 min. In other words, with this oil, the rings will stick at 280 C in 20 min.

The essential test constants—diameter of the rings, weight of the oil sample used, detaching force of 1 kg, cooling time of the rings, etc., were not selected arbitrarily, but are based on the results of serial tests.

The experimental results, presented elsewhere in this article, were obtained with an apparatus differing slightly from the one described above. The steel plate carrying the rings was heated by placing it directly on the metal plate of an electric heater (Fig. 4) without being protected from the air around it. The surface temperature of the steel plate, therefore, was always a few degrees lower than that shown by the thermometer; but as the tests were only comparative, this was not considered to be of any importance.

Plotting the thermal stability against temperature produces regular curves resembling the conventional viscosity-temperature curves of oils (Fig. 5). The thermal stability curves plainly show the specific properties of particular oils. Thus, castor oil has lower thermal stability than mineral oils of equal viscosity

Fig. 4—Electric heater used with plate and rings for un-enclosed heating.



(Fig. 6); mineral oils of equal viscosity but different origin, and therefore different chemical composition, also differ in thermal stability.

Thermal stability is very sensitive to the action of various antioxidants added to oils to improve their properties. Even with admixtures of only 0.1 per cent (the presence of which is not readily detectable by physical or chemical test) the thermal stability varies so widely that it is possible to predict how much better or worse the oil will behave at high temperatures with the addition of the antioxidant.

Experiments were made with five different American antioxidants: DuPont's tributyl phosphite, Aerolube RS-13, Aerolube RS-14, Santolube-365 and Alox 925. Each was added to two oils having different properties. One of these, termed "mixed," consisted of 50 per cent (by weight) distillate engine lubricating oil and 46 per cent aero engine oil SO. Its viscosity, according to Engler, was 12.9 at 50 C and 2.2 at 100 C. The other oil, imported under the trade name of Lub-oil 34A/32X, had a viscosity of 17.8 at 50 C and 2.88

(Turn to page 102, please)

Design —



For Safety and Dependability With Inland Steel

The buying public has learned to associate steel with safety and dependability. People ride in steel trains over steel rails, live and work in structures made strong with steel, travel the highways in steel automobiles, cross streams on bridges of steel, farm and manufacture with steel equipment, use steel furniture and innumerable household appliances—all with the knowledge that these things, made of steel, cost less, are more durable—have greater strength and safety.

Steel affords strength without excessive volume and weight. It is strong in tension as well as in compression. It quickly recovers from strain, and is resilient under shock. Steel reduces fire hazard to the minimum, and is practically unaffected by climatic conditions. Steel normally resists corrosion and can easily be more fully protected against such action. Steel absorbs neither moisture nor odors.

Inland has been a leader in the development of steels to meet changing industrial requirements—has continuously cooperated with industry to make available various physical properties and surface textures that give steel its unsurpassed flexibility in product design and fabrication.

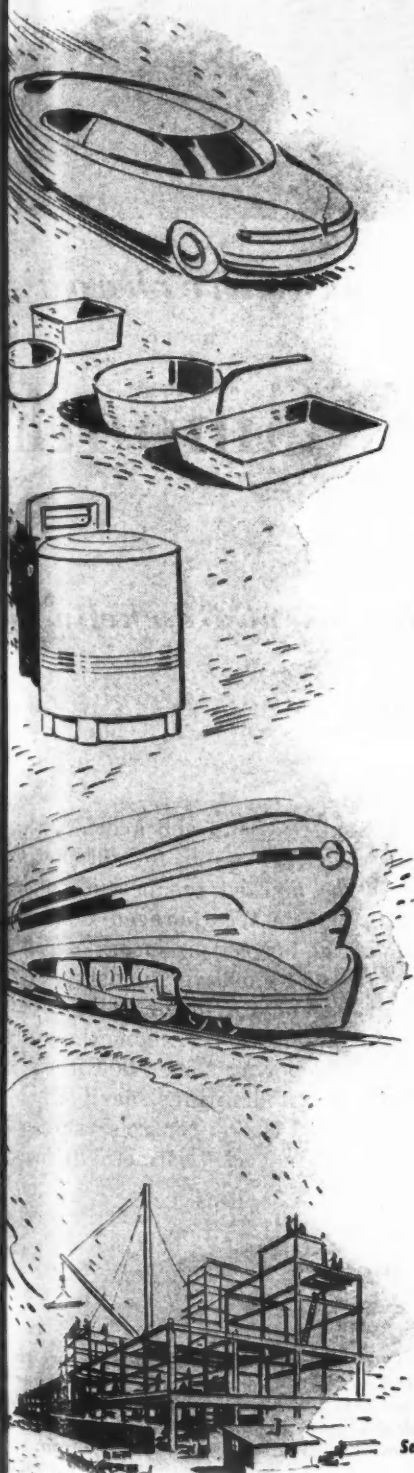
The Inland laboratories and the Inland staff of engineers and metallurgists are at your service to help you meet the design problems of today and of the post-war period. We will be glad to help you on any design, material selection or fabricating problems.



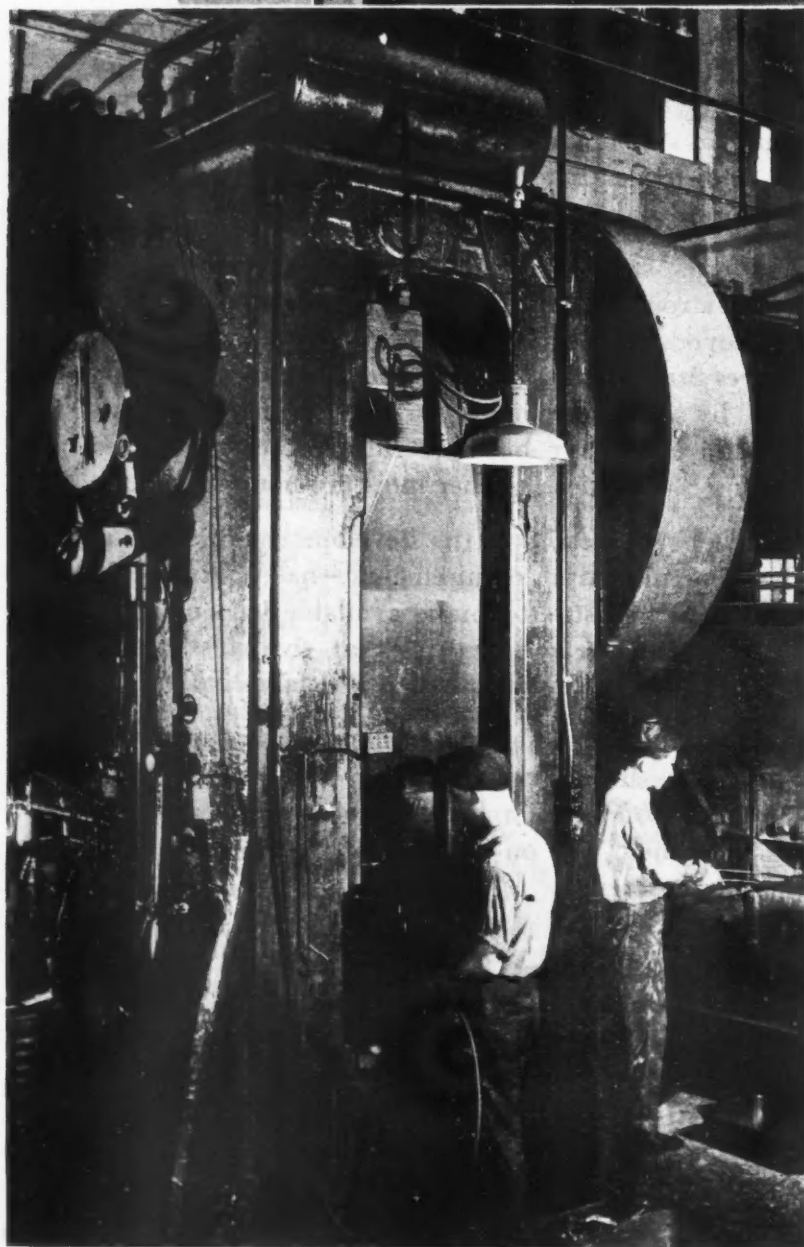
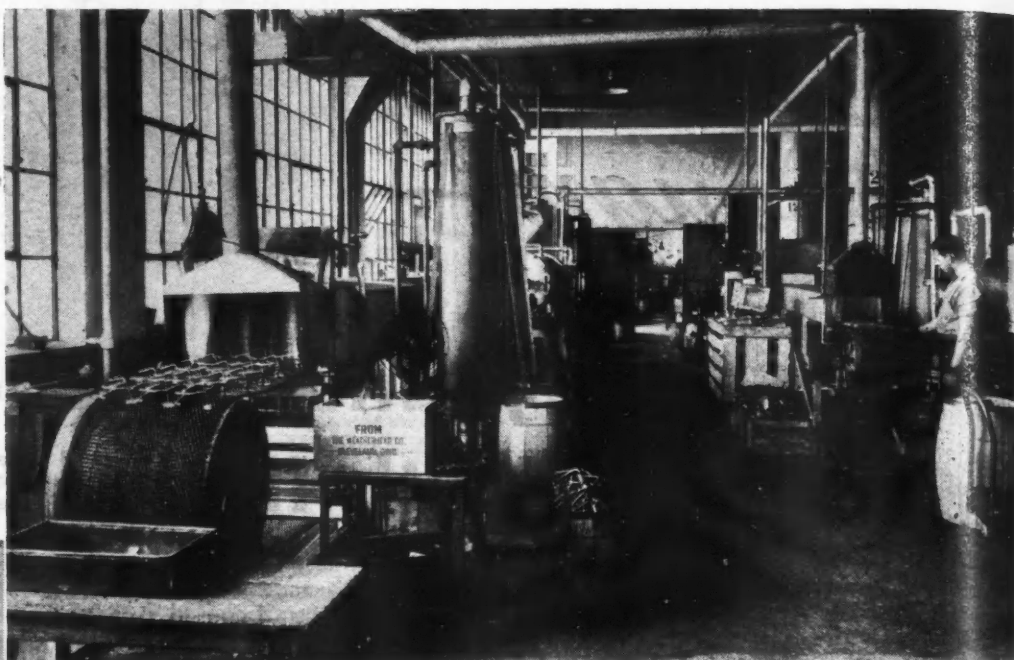
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Hydraulic cylinder assemblies and certain other parts are hydrogen-brazed in this department. Two of the special General Electric hydrogen brazing furnaces may be seen here. These furnaces employ operating temperatures upwards of 2150 F, and are served by heat-resistant steel conveyor belts.



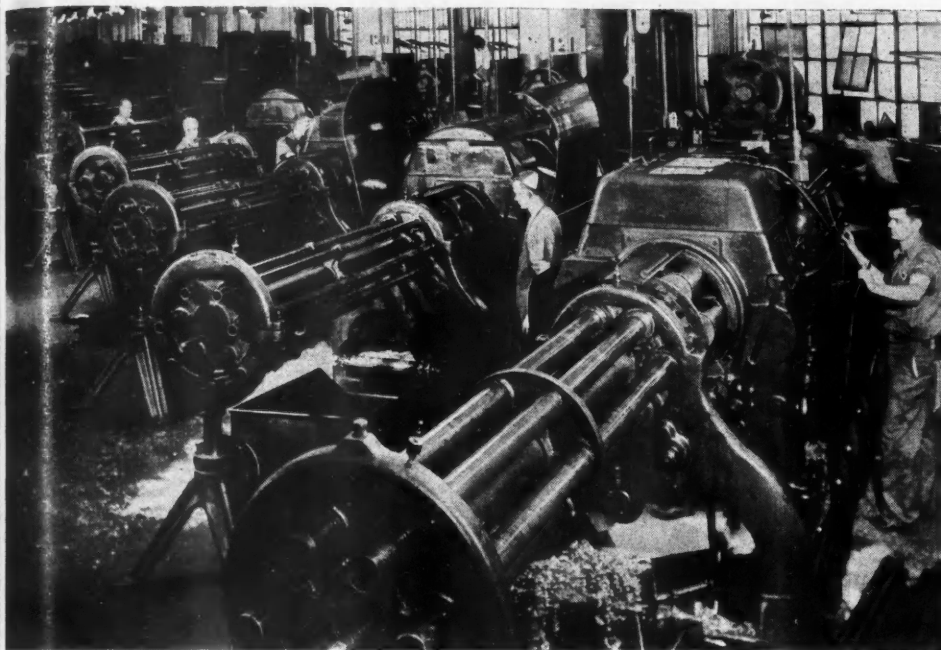
Close-up of one of the 1000-ton Ajax presses installed in the forge shop. The heating furnace for this press may be seen at the right. This department produces thousands of non-ferrous forgings of every description.

Weatherhead's Pr

Smooth F

By Joseph Geschelin

A PRIMING cup and a drain cock of clever design for automotive use marked the beginning, in 1919, of The Weatherhead Co., now one of the largest producers of parts for the automotive industry, for aviation, and for marine and Diesel engine applications. Among the products—numbering some 3000 items—are valves and fittings, flexible hose assemblies, choke controls, shut-off cocks, drain cocks, Ermeto fittings,



Perspective view of a battery of National-Acme-Gridley, multiple-spindle automatics. This department, containing various makes and types of equipment, is claimed to be one of the largest in this country.

Production Set-up Provides

Flow of Thousands of Products

etc. During the war, the company has added such special products as hydraulic actuating cylinders for aircraft, bomb fuses and other bomb parts, rudder control, and plastic valves.

Following a period of wide acceptance in automotive circles, Weatherhead in 1937 acquired the plant it now occupies—the former Cleveland plant of the Hupp Motor Car Co., which was in turn, the home of the famous Chandler and Cleveland motor cars. During the same year plants were built in St. Thomas, Ontario, and in Columbia City, Ind. The West Coast plant at Glendale, Cal., was established in 1941. The company now employs over 4000 workers and operates a floor space of some 529,377 sq ft.

Since Weatherhead turns out over one million parts per day, the endless variety of product—in types and sizes and materials—demands great flexibility in production planning and scheduling and implies operation as an enormous job shop. To facilitate flexibility the plant has been departmentalized into functional departments through which the parts are routed in accordance with the routing established for each one. Work-holding devices, tools and fixtures, all are designed for quick change-over for the great variety of parts in process.

Many of the parts are produced as assemblies—either simple or complex—and these are routed to their respective sub-assembly and assembly and test stations to be mentioned later. The variations due to the difference

in size and design of product are further increased through the use of different materials—forgings, bar stock, and tubing in brass, steel, and aluminum. In addition, many parts are made from plastics.

Let us consider briefly the functional departments, among which are the following:

Turret lathe—primarily Warner & Swasey machines.

Automatic screw machines—Davenport, National Acme-Gridley, New Britain-Gridley, Conomatics, and a large battery of Brown & Sharpe automatics.

Grinding department—Cincinnati, Centerless and External.

Drill press—batteries of Bodine multiple-spindle, rotary indexing table machines, Kingsbury multiple spindle drilling machines, Delta single spindle drills.

Forge shop—this produces all of the brass and aluminum forgings. Among the equipment used for this purpose are three 1000-ton Ajax and Minster forging presses.

Anodizing department.

Plating department—with facilities for handling the variety of electroplated coatings.

Heat treating department—principally for hardening tools, but also for the heat treatment of products.

Final inspection departments.

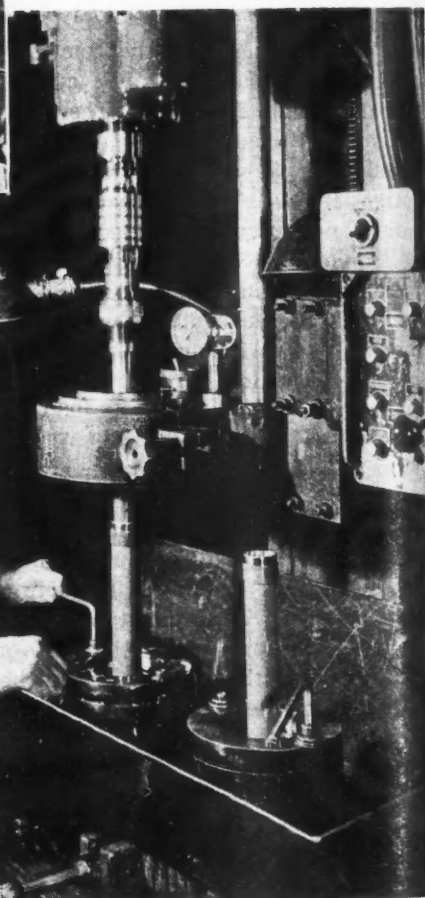
In addition to the foregoing, there is a hydrogen brazing department with a number of General Electric hydrogen brazing furnaces for the brazing of a variety of parts. Another self-contained process department is the paint shop. This consists of a battery of DeVilbiss spray booths from which the parts are transferred to closed circuit monorail conveyors transporting the work through infra-red drying tunnels mounted overhead.

Pressure test bench for final testing of fuel and oil line assemblies under operating pressure conditions.



(Left)—Final assembly bench—here the tested and accepted hydraulic cylinders receive approved tags preparatory to packing.

(Below)—View of one of the Barnes honing machines at the Weatherhead plant in operation of finishing and polishing the inside diameter of the barrel for a Weatherhead hydraulic cylinder.

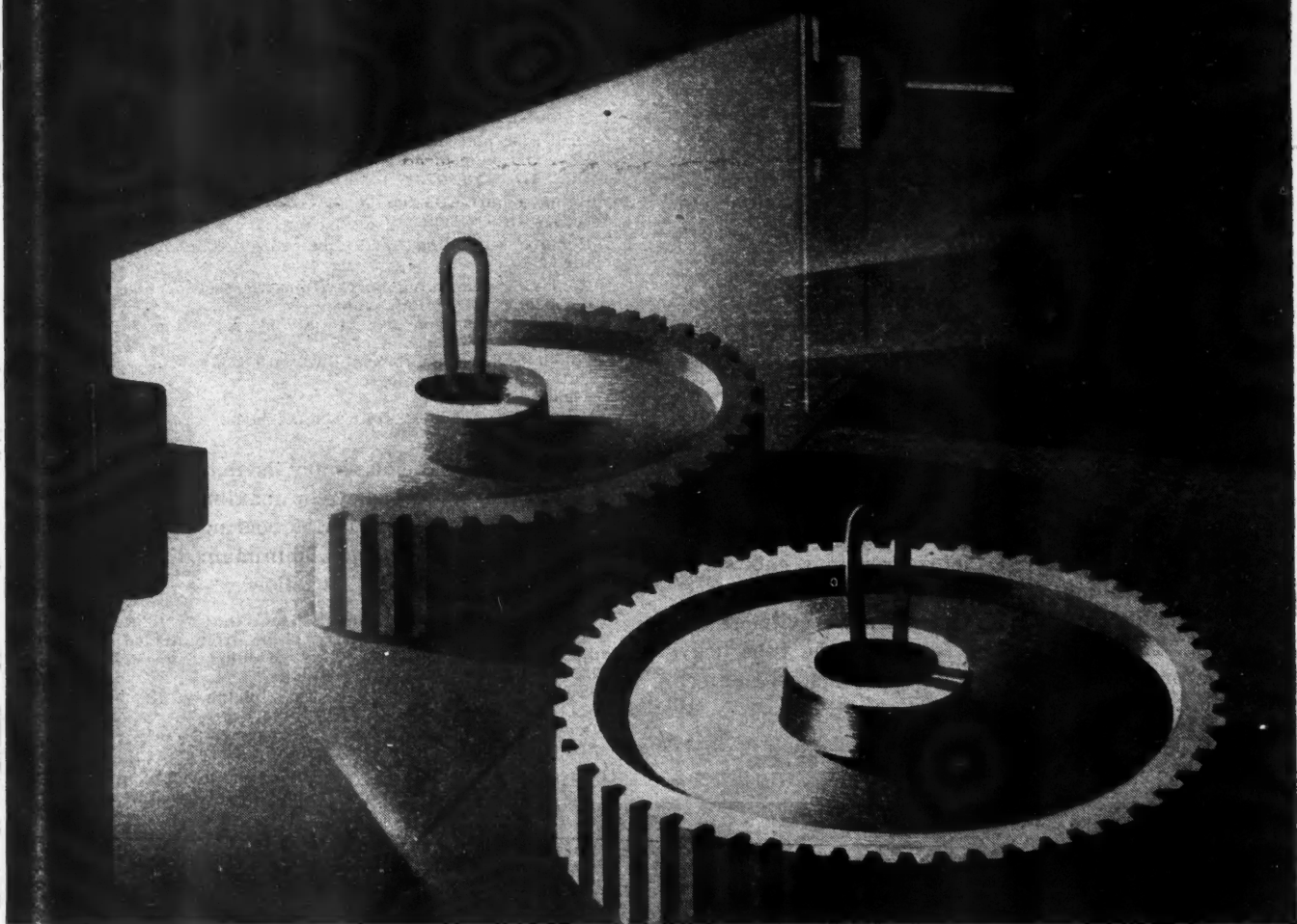


In keeping with present day practice, cemented-carbide tools of proper grade are widely used for metal removal operations on the various machine tools. One of the largest departments in the plant is the tool room which is responsible for the making of tools, dies, and fixtures.

Quality control is a major activity. In addition to the several final inspection departments there is a large gage laboratory provided with the latest types of instruments for the checking and calibration of gages and a routine inspection of all gages and instruments in use throughout the plant. It is of interest to note that all production thread gages are checked through the laboratory at least once in 10 days.

Certain of the products require specialized treatment in machining, assembly and testing. This is true of hydraulic actuating cylinders for example. Most of the machin-

Molybdenum steels require relatively high tempering temperatures and therefore are relatively free from internal stresses.



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ing is centralized in a self-contained department. The cylinders are assembled in a special department, on individual benches provided with test equipment to simulate operating conditions. The rudder control assembly is made up in an air-conditioned booth under standard atmospheric conditions to assure conformity to specifications.

Hose assemblies also are produced in a centralized department. One section has a hose cutting room for preparing hose in proper lengths. Another section is equipped with special hand presses for crimping the fittings. Large high pressure hose fittings are crimped in a heavy hydraulic press. Here, too, are assembled the special hose assemblies with replaceable fittings pioneered by Weatherhead. These fittings are screwed home on small lathes. Basic feature of the hose department is a hose laboratory, provided with testing equipment for commercial and fundamental research leading to an improvement in the product.

Dash controls are made in a specialized department set up for the purpose. Here are found machines for producing the spring-wound tubing into which the control wire is fitted. The assembly of wire and fittings is made on benches.

Owing to the variability of the products made in this plant it is quite difficult to outline specific operations. However, the general character of the operation may be visualized from the high spotting of functional departments and the normal flow of work from one department to another. Obviously, a mass-job-shop setup such as this, implies great managerial skill in the subdivision of operations and in scheduling of flow.

The following group of factory routings shows the detail of operations on a number of special parts of aircraft quality, primarily for hydraulic cylinder assemblies. The first of these is the 3 1/8 in. tube body which is produced as follows from alloy steel tubing:

Cut-off blank, burr ID—4 1/4 Gridley.
Wash.



A partial aisle view of a section in the Brown & Sharpe automatics department at the Weatherhead plant.

Mill slot, one end—Nichols hand milling machines.
Turn thread diameter and OD—Model LR Lo-Swing lathes.
Grind OD, rough and finish in same setting—Cincinnati Centerless Grinder.
Rough bore ID, finish bore ID.
Face, chamfer, and radius—#3U Warner & Swasey turret lathe.
Thread mill long end, thread mill short end—Hanson & Whitney thread mill.
Grind OD—Cincinnati Centerless Grinder.
Zinc plate.
Grind nose both ends—Cincinnati External grinder.
Rough hone, finish hone—Barnesdrill vertical honing machine.
Radius two ends at bore and blend chamfer—Star Engine lathe.

The end cap for this assembly, anodized aluminum forging made in the forge shop is routed as follows:

Cut-off blanks—Andrew C. Campbell Automatic.
Polish off burrs.
Forge—Minster press.
Reforge—Ajax press.
Trim flash, heat treat, age, pickle.
Machine 3-7/16-16 end—#5U Warner & Swasey turret lathe.
Machine opposite end—#3U Warner & Swasey turret lathe.
Process inspect.
Drill for 2 1/2 pipe, taper ream and countersink for 2 1/2 pipe, drill for #10-24 tap, countersink #26 hole, tap #10-24 hole, tap 2 1/2 pipe—Delta 6-spindle drill press.
Drill 3/32 hole—Delta drill press.
Burr OD edge of 3/32 hole.
Burr ID edge of 2 1/2 pipe holes with stone.
Remove burr at edge of .752/.753 hole on both sides and recesses with a scraper.
Remove remaining burrs from recesses in small hole with a cloth wheel.
Removing remaining burrs from recesses at end of 3-7/16-16 tapped holes with cloth wheel.
Remove burr from #10-24 hole by retapping 3-7/16-16 hole.
Process inspect.
Polish OD to blend flash line with body.
Butler buff OD complete.
Anodize OS-200.
Polish .752/.753 hole—Star Engine lathe.
Inspect.

The rod for the assembly is machined from alloy steel, heat treated to develop maximum physical properties, and finished with a coating of hard bright chromium plate 0.001 in. minimum thickness. The routing for this part is as follows:

Cut off—1/32 oversize, machine end that is to have 2 3/4 long 3/4-16 thread. (Note: Remove chips from drilled hole), machine opposite end (Note: Remove chips from drilled hole)—#3U Warner & Swasey turret lathe.
Process inspect, heat treat, draw, pickle—must be free from scale.
Recenter both ends—#2 G.F. Warner & Swasey turret lathe.
Straighten on centers—Straightening press.

Grind 0.750/0.751 on end that is to have 3/4-16 thread only, grind opposite end to 0.750/0.751—Cincinnati external grinder.

(Turn to page 92, please)

WHEN ASSEMBLING THAT MOTOR



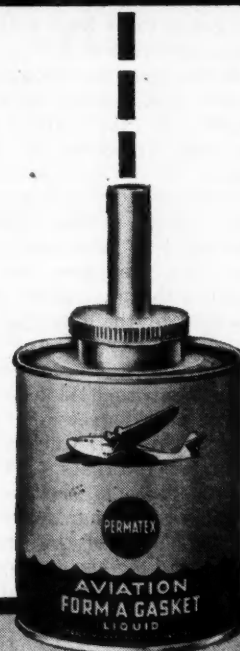
PROTECT AGAINST
Corrosion
AND
Head Seizure

Corrosion quickly attacks many types of cylinder head gaskets. It eats into engine blocks. It ruins cylinder heads, particularly aluminum heads.

Prevent corrosion . . . water seepage . . . loss of compression . . . head seizure.

Apply Permatex Aviation Form-A-Gasket to both sides of cylinder head gaskets and over entire surface of stud bolts. It will produce a non-drying, elastic, adhesive, heat-resisting, non-corrosive seal.

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FORM-A-GASKET NO. 1

Fast drying and hard setting. Used principally for making permanent assemblies, for building up uneven or warped surfaces and for the repair of broken parts. Makes unions leakproof to gasoline, gasoline vapor, kerosene, hot or cold oil, grease and water. Resists highest pressures and greatest strains.



FORM-A-GASKET NO. 2

Dries slowly and remains pliable. Used for general assembling work on all types of gaskets, flange surfaces and screw thread connections. Like Form-A-Gasket No. 1, it makes leakproof, pressure-tight unions but disassembles very easily. Preserves all types of solid gaskets from heaviest metal to thinnest cork.

Airbriefs

By Henry Lowe Brownback

Interest

Aviation is still the big drawing card at technical society meetings. I recently attended one in a hall which gets about half full when ordinary automotive discussions are being held, but which overflowed into the corridors for a talk on aviation. This adds up to the fact that many engineers, industrialists and workers see in aviation one of the great opportunities for advancement and for a secure future.

Competition

With the inevitable shrinkage in aircraft employment at the end of the war, competition for the places available is going to be keen and it behooves everyone interested in staying in the aircraft business to recognize this and to realize that, unless he really has a lot to offer in return for a job, he had better look elsewhere. It will not be enough to have a degree or degrees to hold a technical job nor membership in a union to hold a shop job. Up to the present most of the people in the industry, save the rare ones who were in it before the post 1938 "boom," have been sought by the employers, but from V-Day on they will have to fight to hold their places. The labor unions will probably fight to hold a seniority line but, with the degree of shrinkage, I doubt that this will work and it is not for the best interests of the industry that it does. It is the world's worst fallacy to rate a man's aptitude for a job by the length of time he has spent on it and not by his energy, diligence, intelligence and natural ability.

Radar

Perhaps the most astounding discovery made in connection with military aviation in the electrical field has been Radar. Without this new method of detection anti-aircraft gunners would have been helpless at night as they would have been forced to aim at the sound of the attacking plane. With the speed of aircraft approaching that of sound the error would have been very great as the noise appears to trail a considerable distance back of the plane. This is particularly true of jet-propelled aircraft which are silent when ap-

proaching, but which make a considerable noise after they have passed.

Radar has made night pursuit practical. Before its invention a night fighter had to take off looking for a plane against the moon or the sky or for exhaust flame. On dark nights this was impossible, or a most hazardous proceeding, as a pilot had no way of locating other aircraft in flight. Radar changed all of this and here again it permitted the spotting of jet-propelled planes which show no exhaust flame unless one looks directly into the jet orifice and sees the dull red glow of the turbine element. Needless to say, radar will make postwar flying far safer than it has ever been as it will permit a pilot to locate any other aircraft in flight.

Cost

All of these improvements and safety devices are delicate and costly and will add to the cost of any aircraft carrying them. Cost is important in any article but in the case of aircraft it can be more easily absorbed in a large passenger plane than in Joe Doak's "flivver" plane. However, it may become necessary for J. D. to carry at least the minimum amount of instrumentation necessary to keep him from being dangerous to other aircraft or to stay out of the air save in very clear weather during daylight hours. I believe that the field of low-cost practical aircraft instrumentation is the most promising outlet for ingenuity in the industry.

For years motor boat fans have given the Coast Guard lots of worry by breaking down out in the ocean with no way of letting anyone know where and then spending hours looking for them after they were reported missing. Today private planes come into airports with little warning and not knowing just what the actual ground situation is. Some simple little device like the "Handy Talkie" should be built for a little more than the price of midget radio sets. This device will have to be built into the plane at the factory otherwise advertising and selling costs will make it too expensive. Automotive accessory parts cost, at retail, several times the cost of material and labor, so you can imagine what the dash panel of your low-priced car would cost were it not included in the price of the car.

Conservation

With the war on it has been possible to preach a certain degree of conservation—Save Fats! Save Paper! Save Tin Cans, etc.! and Boy Scouts have been permitted to gather the salvage and sell it. To date the job has not been a success. You can still go over the meadows between Newark and New York and see the "fills" gleaming with metal and clouds of smoke rising from burning corrugated cartons. As a nation we are wastrels and often waste has been encouraged as a means of selling more products. Where these products are vegetable or animal they can, through proper production, be replaced, but where they come from minerals, the removal of the latter just leaves a hole in the ground.

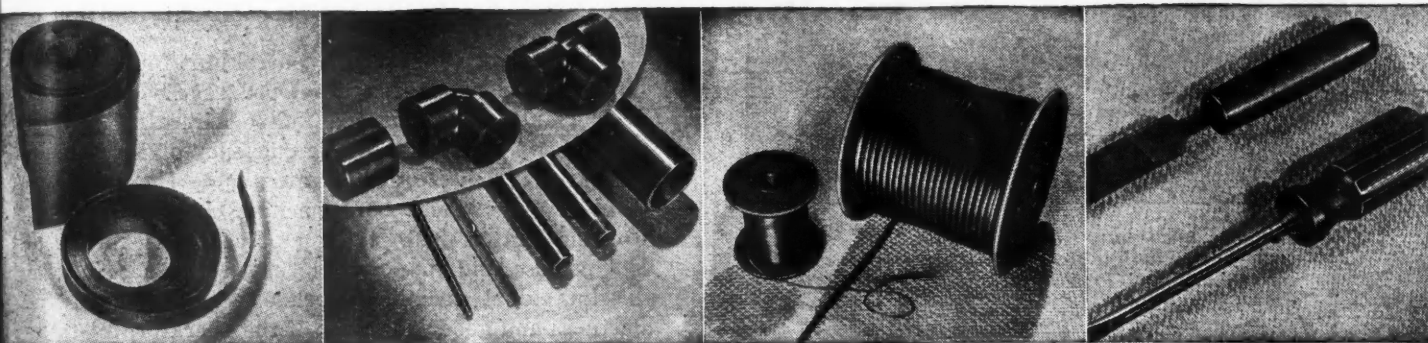
It is easy to say that we should "produce" as much metal as we can as this "production" means wages and material which, in turn, means wealth. The theory is based upon a fallacy as we do not "produce" metals. Our available metallic and mineral supplies were all produced ages ago and are irreplaceable deposits which we are frittering away at an alarming rate and robbing future generations of their rights! It is a crime to waste any metal in any degree. Every particle of it should be reworked, adding only enough fresh material as may be necessary to maintain its quality. It may be momentarily profitable to mine half a million tons of iron ore, convert it into tin cans and throw these on the dump. Certainly it would cost far more to salvage them than it does to mine fresh metal, but a large part of that metal remaining in the ground can serve future generations, while buried under a city dump it is lost forever. I read with amazement that we should continue to produce rubber from petroleum when it can be made from grain which can be replaced every year or taken from trees which can be grown. Canada requires that land cut over for lumber or pulp be replanted. We do not even remove the slash from our cuttings as it would "cost too much."

In our anxiety to get every resource of the nation converted into cash for our immediate use we are milking our resources and selling part of it to countries which are hoarding theirs. Some day when we have run dry and have to go on the market to buy from outside then we shall see what it is to be a "have not" nation. Our wealth and our strength has been in the fact that we are a new, young nation with great natural resources and we are throwing this strength away. Try, today, to buy prime aircraft lumber or prime boat oak. It is worth its weight in gold. We have been cutting it by the millions of feet for years, but how much have we planted? In self-protection industry and finance and particularly aviation with its youth and vision should lead the conservation parade!

what you should know about

STYRALOY

Dow's new plastic

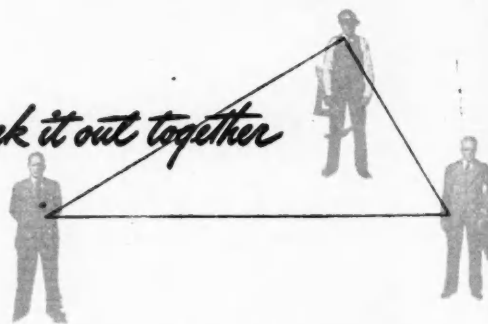


Enthusiastic response from many electrical engineers followed the recent announcement of Styraloy 22. Such special interest is well-founded for this new, Dow developed synthetic elastomer already occupies an important place in the field of low-loss, low capacitance, high dielectric strength, insulating material.

Developed initially for insulation uses where low loss at high frequency was an important factor, Styraloy 22 soon attracted attention for other uses . . . for aircraft ignition installations because of its flexibility at low temperatures and freedom from corona attack even at high altitudes . . . for radio gaskets, bushings, and similar products . . . for combining with synthetic rubber to provide flexible, water resistant wire insulation.

These are some of the things you should know about Styraloy 22—so you can determine where this new product can best fit into your own plans. Complete data is available on request.

Let's work it out together



We at Dow know from experience that success in plastics is not a one-man nor even a one-industry job. It calls for the combined skill and cooperation of manufacturer or designer, plus fabricator, plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

PRESENT AND POTENTIAL USES: One-piece cable sheathing; handles for tools, household appliances, etc.; gaskets; bushings; coil forms; floor mats; scuff plates; many applications still to be ascertained.

PROPERTIES AND ADVANTAGES: High dielectric strength, low power loss. Power factor only .005 at 100-300 megacycles. Flexible and shock resistant from -90°F. to 212°F. Specific gravity less than 1 (floats in water). Water absorption only .2 to .5%. Resists heat, ozone, and most chemicals. Highly resistant to abrasion. Resists permanent indentation. Ideally suited to extrusion of complex cross sections and readily fabricated by other molding techniques. Easily machined.

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PLASTICS

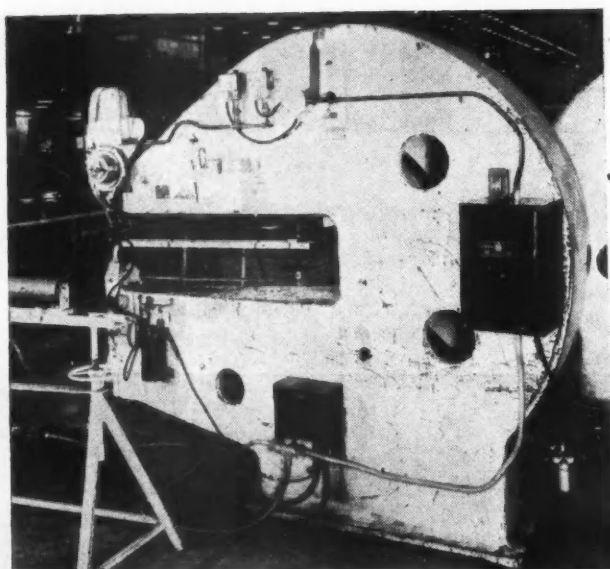
STYRON • ETHOCEL • ETHOCEL SHEETING
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Sequence Control for

Automatic Riveting

By **Walter Mandel**

Electrical Engineer,
Consolidated Vultee Aircraft Corp.



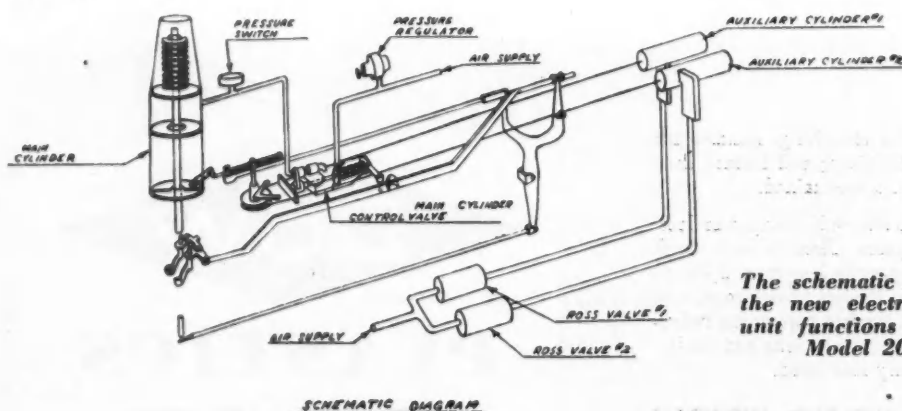
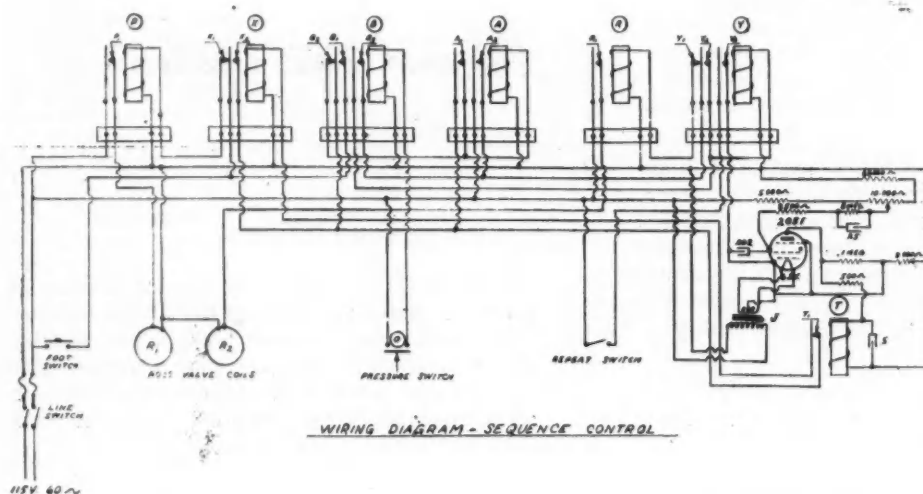
One of Consolidated Vultee's Model 2002 Erco riveters with a new electronic sequence control unit attached. The overall efficiency of this machine has been increased about 20 per cent by means of the electronic control unit.

AN ELECTRONIC sequence control unit for automatic riveting has been developed at the San Diego plant of Consolidated Vultee Aircraft Corp. for the purpose of increasing the efficiency of Model 2002 Erco riveters. Before this unit was developed, it was necessary for Model 2002 machine operators to control complicated flush riveting processes by means of foot pedals; and, because the speed and accuracy of the individual machine depended entirely upon the alertness and good judgment of the operator, mistakes were occasionally made, causing excessive losses in time and materials and necessitating the premature replacement of machine parts.

With the new electronic sequence control unit, the Erco machine operator is required to depress only a single lever; thereafter, the entire punching and riveting sequence is accomplished without human assistance. Time studies have revealed that this produces a 20 per cent increase in efficiency and parts savings of more than 35 per cent for the Model 2002 Erco machines.

Physically, the new unit resembles a small radio set. It governs the operations of an Erco riveter simply by actuating a series of electrical circuits in a suitable sequence. The electrical circuits in turn actuate the

The schematic diagrams indicate how the new electronic sequence control unit functions in connection with a Model 2002 Erco riveter.





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fighting is finished*

Until the war is over, millions of Sealed Power Piston Rings will continue to go into fighting machines. After peace returns, the largest and best manufacturing facilities in 33 years of Sealed Power history will be ready to serve you. Meanwhile, Sealed Power engineers invite your use of their experience and Sealed Power's unequalled laboratory facilities to help make your good engines even better.



SEALED POWER CORPORATION
Muskegon, Michigan • Windsor, Ontario

Buy more War Bonds and Keep Them! Pay \$3—Get \$4!

Rings are checked for circularity on light test machines

SEALED POWER

PISTON RINGS

PISTONS—CYLINDER SLEEVES

Reconversion in Automobile Plants Started Before V-E Day

Recent Cutbacks and Cancellations Have Paved Way, More Reductions and Outright Stop Orders to Come

For all practical purposes, V-E Day had passed in the automobile industry before May 8. Recent cutbacks and cancellations have started the industry on the road to reconversion, and more reductions and outright stop orders for war goods will come gradually within the next 30 to 60 days.

Although there have been numerous predictions that cutbacks during the quarter beginning when the German war ended will be greater than WPB's first estimate of 12 to 15 per cent, spokesmen for that agency still stand on the original estimate. They say that orderly procedures have been set up for an overall reduction of about 15 per cent, and that by the time fighting in Europe stopped enough production adjustments had been made so that there was little need to make changes.

Evidence of the gradual transition to a one-front war that was taking place is seen in the recent action of the Air Forces in putting three types of aircraft on a one-front production schedule. The Army has cancelled several tank plant expansions, and has adopted a policy of stopping work on all plant expansion not needed for a one-front war if the work cannot be finished before Sept. 1. Tank cutbacks, while not yet affecting current rates of production, have been reduced at the open end of the contract, and similar reductions of planned peaks in small arms ammunition, medium artillery and mortar ammunition have been made. These tapering off moves, together with expected further reductions in various munitions, will spread the shift over a fairly long period, rather than allow full-tilt production up to a certain day and then chop it off abruptly. The method permits industry to start at least partial reconversion in advance of the day when resumption of cars will be permitted.

The uncertainty about what contracts will be cut back or terminated and the extent of reductions still is a major obstacle standing in the way of any determination of the time it will take automobile manufacturers to get back into civilian production. With as many as five or six different contracts in his plant, one manufacturer may have two or three of them cut off

cleanly while the rest run indefinitely. Another may be cleaned out of war work entirely, giving him a distinct advantage in getting back into his peacetime production. The first manufacturer, if he knew just where his contracts were to be cut back, could rearrange his plant space in order to carry on war work and automobile production side by side. The industry has been trying for months to get some kind of clear-cut decision on this point from procurement officers of the armed forces, but with little success.

Machine tools, which have been rated as No. 1 problem, have been given preferential treatment so far as priority is concerned, and the problem now is to find the capacity in the machine tool industry to furnish the required bottleneck machines needed to resume partial resumption. The Automobile Industry Advisory Committee has reported that it is not too optimistic about the possibilities of machine tool builders filling all the required orders in time for production to get going when plants are ready. They admit that some of the builders have greatly reduced backlogs of war orders, but say that many of the larger companies

have large military orders still to be filled ahead of essential civilian bookings and that it is these larger companies that must be counted on to provide the bulk of the machines needed.

Textiles for body trim and fabrication also are assuming a critical aspect. The greatly increased needs for the Pacific war probably will create a bottleneck that will be difficult to crack. The principal problem is manpower, since the machinery and raw materials are available. However, the wage scales paid in the textile industry are so much lower than those prevailing in most other lines, that it will be difficult to induce workers to take jobs in the mills. Even though workers are laid off in Detroit, they are very likely to sit out their 20 weeks of unemployment compensation, rather than to go south for low-paying jobs in textile factories. The problem is complicated by the fact that production of textiles has been reduced because workers have left for higher paying jobs. WPB and the industry agree that there are only two ways to meet the need: Channeling of workers into textile jobs, or diverting part of the available civilian supply to automotive uses. The industry is opposed to further reduction of the civilian supply, except as a last resort to absorb unemployed automotive workers, and have asked WPB and WMC to make every effort to get manpower into the mills. Automobile plants require a 60-day lead time on textiles before they can be used.

Ford's Willow Run Plant May Be Abandoned

Ford Motor Co. has no plans for postwar use of the \$100 million Willow Run bomber plant which it has operated for the Army Air Force during the war, and the military has decided that the huge facility has fulfilled its war-time purpose, leaving an expensive and important question mark over the ultimate disposal of the huge installation.

Henry Ford, II, executive vice president of the company, told employees recently, that his company "is not in the least reluctant to see this plant or any plant discontinued making implements of warfare—once the war need ceases." He added that Willow Run is a war plant constructed to meet a war need, just as a carrier, battleship, or a bomber, and if it has hastened the end of the war, it is as expendable as a battleship—and no more expensive.

"We also agree," he said, "that to extend the operation of such a gigantic plant beyond the actual need of it for the pursuit of the war is an unneces-

sary waste of plant, personnel and the taxpayers' money. We do not intend to solicit additional war work for Willow Run, but if the government of its own volition places war work here, we'll handle it as we have before."

Mr. Ford also gave a hint that his company intends to maintain employment levels as high as possible by telling the bomber plant workers that Ford expects to be able to offer them jobs somewhere in the Detroit area just as soon as the government gives the necessary go-ahead on civilian production. The bomber plant is scheduled to wind up its operations by Aug. 1, but some reports indicate that the end may come sooner than that.

Although he gave no reason why his company is not interested in Willow Run for postwar use, even though Henry Ford about a year ago stated that it might be used for production of farm tractors and equipment, it is un-

(Turn to page 46, please)

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derstood in Detroit that the company considers the plant too large and expensive to operate. It is reported that a study was made on the feasibility of using it for automobile body production, but that the cost was too high. Also, it should be pointed out that in 1923, Ford's peak production year, more than two million cars were produced with smaller facilities than the company now has. Also, there are DPC buildings located within the River Rouge properties that Ford can buy if additional facilities are needed. On the whole, it appears that there would be very little economic logic for the company to in-

UAW-CIO "Model Contract Clause" Provides No Job Protection for Returned Veterans

Organized labor is sitting on a powder keg in respect to its stand on seniority for returned veterans of this war who have no prior job rights. The veteran who had a job before he went into service has no worries on this score because his seniority accumulates while he is in service. Those who went directly into the service from schools or who had no opportunity to work in a factory before, however, are out in the cold.

Although the UAW-CIO has brought out a "model contract clause" to deal with this problem, actually the provision does practically nothing at all for the service man with no job rights. It provides that he shall be given seniority equivalent to the time he spent in service, which is splendid if he gets a job, but it falls far short of practicality in that it prohibits him from using the seniority to get a job. In other words, the seniority is useless in getting hired, since all persons on the seniority list must be hired before he is given a chance. This has not been too important to date, but with cutbacks coming along fast and employment on the decline following the defeat of Germany, the chances of the returned veteran with no prior job rights landing a job in union plants are becoming slim.

Employment in the automotive industry before the war was between 800,000 and 900,000, and at the peak of war production in late 1943 was between 1.1 and 1.2 million, with 250,000 former employees in the armed forces, all of whom have job rights on their return. Considering the turnover and the fact that seniority may be carried on from one year to perpetuity, a safe estimate would be that after the war there will be 1.3 million persons on seniority lists in the automobile industry who would come ahead of veterans without prior job rights if the present model clause is retained. One manufacturer estimates that under such a condition, he would not be able to hire such a service man for 20 years. Even though the industry is expecting to hire more persons than it used in prewar days, it cannot be expected to do the impossible.

vest in a huge and expensive plant, located 20 miles from its main base of operations, when it has once before proved that it can produce with existing facilities the number of cars it has announced as its postwar goal.

Various reports and speculations about the future of Willow Run have it as an adjunct to Wright Field, a standby government arsenal, a multiple-tenancy project inhabited by a large number of small businesses, or a warehouse for surplus war equipment and materials. The only definite statement that can be made about it is that nothing definite has been decided.

Although 34 companies, including Studebaker, Graham-Paige, and Packard, have accepted the model clause, the Big Three automobile companies—General Motors, Chrysler, and Ford—will have none of it, because they feel it gives the returned veteran nothing. What they are fighting for is equal opportunity for the service man, by giving him the right to use his month-for-month seniority to get a job. If this is done, he will be able to pit his accumulated seniority against that of persons who went into the war plants at high wages while the soldiers were fighting the war at risk of life and limb for \$50 a month. This appears to be the most eminently fair solution to the problem, and it remains to be seen whether the unions will accept it or be forced to it by public opinion and organized pressure from politically powerful veterans' groups when returning soldiers are turned back at the gate in favor of workers who stayed safely at home.



AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the April 15 issue of *AUTOMOTIVE and AVIATION INDUSTRIES* went to press:

AMERICAN STEEL AND WIRE CO., U. S. Steel Corp., Cuyahoga Works, Cleveland, Ohio.
THE AMERICAN WELDING & MFG. CO., Warren, Ohio.
BATAVIA METAL PRODUCTS, INC., Batavia, Ill.
BORG-WARNER CORP., Ingersoll Steel Disc Division, Chicago, Ill.
THE BURGESS CO., INC., Cleveland, Ohio.
FORD MOTOR CO., Willow Run Bomber Plant, Ypsilanti, Mich.
GENERAL MOTORS CORP., Fisher Body Pontiac Division, Pontiac, Mich.
THE HARDING MACHINE SCREW CO., East Liberty, Ohio.
PACIFIC RUBBER & TIRE MFG. CO., Oakland, Cal.
WALDES KOH-I-NOOR, INC., Long Island City, N. Y.
WESTERN CARTRIDGE CO., United States Cartridge Co., St. Louis Ordnance Plant, St. Louis, Mo.

★ "E" Star Awards ★

for continuous meritorious services on the production front have been awarded to the following firms:

AMERICAN FOUNDRY EQUIPMENT CO., Mishawaka, Ind.
BORG-WARNER CORP., Rockford Division, Rockford, Ill.
CHRYSLER CORP., Tank Arsenal Proving Ground, Utica, Mich.
STEWART-WARNER CORP., Division One, Chicago, Ill.
WESTINGHOUSE ELECTRIC AND MFG. CO., Industrial Electronics and X-Ray Divisions, Baltimore, Md.



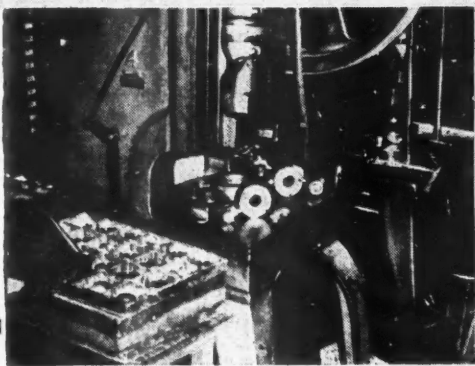
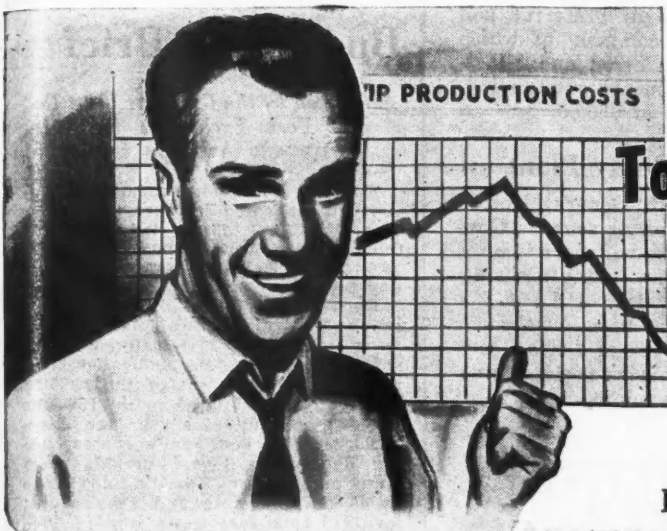
Interior View of C-97 Transport Plane

This illustration shows a 1½-ton truck parked in the upper fuselage section of a Boeing C-97 transport, companion of the B-29. Two such trucks can be accommodated on the main deck with other equipment and personnel, or cargo may be carried simultaneously in the two lower compartments of the double-decked plane.

How This Tool and Die Job Analysis

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Select your tool steel by proved standards. When you need properties like extreme *toughness* or extra *wear resistance* in a tool, use the Carpenter Matched Set Diagram to quickly point the way to the *one* tool steel that will do the job best. You can actually predetermine tool performance when you use this method. To find out more about it and the ways it can help to save time, tool steel and money, ask for the Carpenter "Matched Tool Steel Manual" described below.

Your 2nd Step:

Check up on heat treating methods. To help your heat treaters get proper hardening results, ask for Carpenter's Heat Treating Guide, free to tool steel users in the U. S. A. It's a handy slide chart that spots each steel on the Matched Set Diagram and gives forging heat, normalizing heat, annealing treatment, recommended drawing range, etc. It also contains tips on quenching, oxidizing atmospheres, etc. A note on your company letterhead will start your Guide on its way.

Your 3rd Step:

Check actual tool performance... as the first step to reducing machine shut-down time. You can cut tooling and production costs by keeping accurate records of the pieces produced between grinds, or before tools must be re-made. It's a sure way to keep tabs on your tool steel selection and heat treating decisions.

HERE'S THE KEY TO YOUR JOB ANALYSIS PROGRAM!

This 167-Page Carpenter "Matched Tool Steel Manual" makes it easier to get every tool made right the first time. It contains an 80-page Tool Steel Selector indexed by kinds of tools. A flip of the pages shows the recommended steel for each type of tool. This Manual is free to tool steel users in the U. S. A., so for your copy, write us a note on your company letterhead.



Carpenter MATCHED TOOL STEELS



The Carpenter Steel Co., 103 W. Bern St., Reading, Pa.

Westinghouse Changes Company Name

Stockholders of the Westinghouse Electric and Manufacturing Company at their recent annual meeting voted to split the company's stock on the basis of four shares for one and also to change the company's name to Westinghouse Electric Corporation, for simplicity and brevity.

Purpose of the stock split, according to A. W. Robertson, chairman of the company, is to broaden the base of Westinghouse ownership by making the stock available at a lower price.

Authorized capital stock of the com-

pany today is 4,000,000 shares, consisting of 80,000 shares of preferred and 3,920,000 shares of common, of which 79,974 shares of preferred and 3,132,816 shares of common are outstanding, all with a par value of \$50.00.

New Delco-Remy Plant

Delco-Remy Div. of General Motors will start construction as soon as Governmental regulations will permit on a new storage battery manufacturing plant at New Brunswick, N. J. A 27-acre site already has been purchased. B. A. Dollens, manager of Delco-Remy operations, will supervise building and operation of the new plant.

Business in Brief

Written by the Guaranty Trust Co., New York. Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Further expansion of business activity is indicated by current reports. The New York Times index for the third week of April stands at 144.2, as against 142.3 in the preceding week and 145.1 a year ago.

Department store sales as reported by the Federal Reserve Board for the week ended April 21 registered a substantial increase, the indicated total reaching 191 per cent of the 1935-39 average, as compared with 156 the week before and 163 a year ago. Comparisons with last year's corresponding figures for longer periods show gains of 3 per cent for the four weeks ended on that date and 14 per cent for 1945 thus far.

Electric power production increased contra-seasonally in the third week of April and was 1.5 per cent above the comparable level last year, as against a similar rise of 0.6 per cent recorded a week earlier.

Railway freight loadings in the same period totaled 864,063 cars, 2.1 per cent more than for the week before and 3.0 per cent above the corresponding number a year ago.

Crude oil production for the week ended April 21 averaged 4,797,915 barrels daily, 13,150 barrels below the figure for the preceding week but 370,563 barrels more than the output a year ago.

Production of soft coal in the week ended April 14 is estimated at 10,270,000 net tons, as against 7,720,000 a week earlier and 11,710,000 tons a year ago. The output thus far in 1945 is 8.9 per cent below the corresponding quantity last year.

Engineering construction contracts awarded during the week ended April 26, according to *Engineering News-Record*, total \$32,332,000, a sum that is 46 per cent above the figure for the preceding week and 21 per cent above the total for the corresponding week last year. For 1945 to date, however, the contract total is 12 per cent below the comparable figure in 1944.

The Irving Fisher Index of wholesale commodity prices registered a nominal recession in the week ended April 20, standing on that date at 114.88 per cent of the 1926 average, as against 114.98 a week earlier and 112.82 a year ago.

Member bank reserves increased \$126,000,000 during the week ended April 25, reflecting a rise of \$337,000,000 in total Reserve Bank credit, an increase of \$221,000,000 in Treasury deposits with the Reserve banks and other changes. Excess reserves remained at an estimated total of \$800,000,000. During the same period, earning assets of reporting member banks declined \$233,000,000, including a further recession of \$20,000,000, in commercial, industrial and agricultural loans.

Admer to Handle Aro Tools

Admer Associates, Cincinnati, Ohio, have been appointed by the Aro Equipment Corp. as authorized jobbers for Aro industrial pneumatic tools, under the supervision of Mr. J. W. Littleton, local division manager in the territory.

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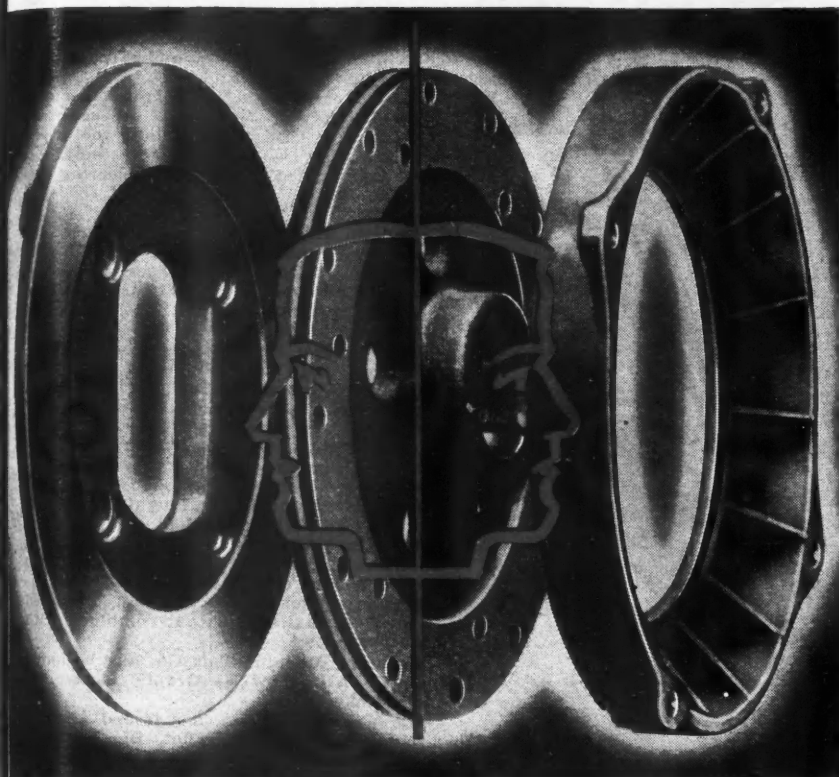
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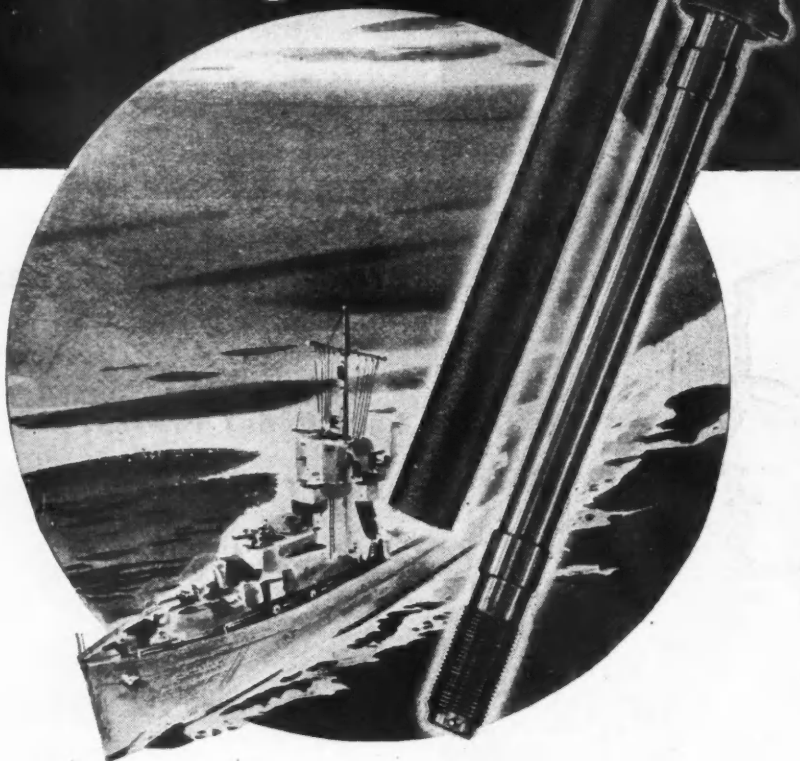
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PUBLICATIONS

Barnes Drill Co. has issued a new Bulletin 151-C describing its line of magnetic-auto-matic coolant chip separators.*

The Muskegon Piston Ring Co. has published an Engineering Data Bulletin on No-Scuff Compression Rings. It describes and features the advantages of the new ring together with supporting test data.*

The Bristol Co. has announced the publication of a bulletin describing its new line of wire belt hooks for all types of flat belting. The bulletin is illustrated and gives specification information and prices.*

Carpenter Steel Co. has a new folder containing information on tool bit selection. Another folder on air-hardening tool steels has also been issued, which gives details of the Matched Set Method for selecting air-hardening tool steel best suited for each specific job.*

Bulletin RDP-107 has been released by Fansteel Metallurgical Corp., intended primarily for design engineers who use rectifiers or other sources of direct current in their products. Its title is Engineering Manual on Fansteel Selenium Rectifiers.*

The Fellows Gear Shaper Co. has published a 48-page book, *The Art of Generating with a Reciprocating Tool*. It is a basic treatise on the art of generating as performed by a reciprocating tool, with all the variations made possible by different combinations of rotative and transverse movements of work and cutting tool, in any direction required and in any angular relationship. The booklet is well illustrated.*

Bulletin VAD-44 by Colonial Broach Co. describes its standard line of improved Dual Ram broaching machines for surface broaching. These machines are especially designed to provide maximum output combined with high precision.*

Rockford Machine Tool Co. has issued a bulletin on its new Hy-Draulic Slotter, 20 inch stroke.*

Hercules Powder Co. has issued a small 8-page non-technical leaflet, *Big News in Lacquer*, which lists the important factors responsible for the developments of the new high solids lacquers, the advantages of using them and includes a short history of the development of lacquer as a protective coating.*

The American Chemical Paint Co. has issued a new folder on Deoxidine, a rust remover and metal cleaner.*

The Lincoln Electric Co. has issued a revised edition of its booklet, *101 Welding Ideas for Low-Cost Maintenance*.*

Parker-Kalon Corp. has issued a new improved edition of its *Fastenings Catalog Data Book*. Considerable new information has been added on the many types of screws, along with well illustrated instructions on where and how to use them. Tables have been improved and simplified to make the catalog more useful.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

PERSONALS

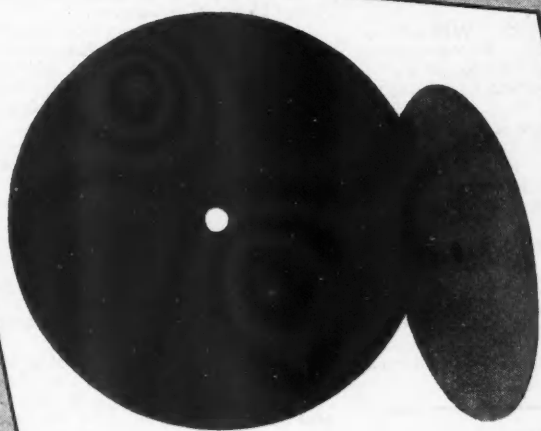
Recent Appointments among Automotive and Aviation Manufacturers:

Consolidated Vultee Aircraft Corp., Irving B. Babcock, Chairman of Board.

Lincoln Electric Co., Gorham W. Woods, Engineering Staff.

Bell Aircraft Corp., Robert J. Woods, Special Technical Adviser to President.

Houdry Process Corp., Henry D. Noll, Manager of Project Analysis Dept., W. E.



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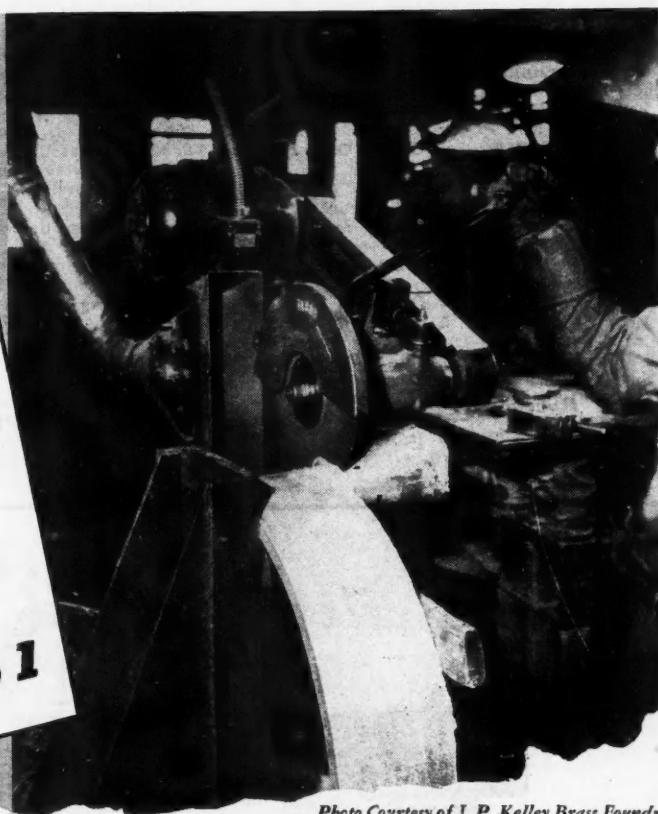


Photo Courtesy of J. P. Kelley Brass Foundry

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Federal Motor Truck Co., Thomas R. Lippert, reelected President.

Jacobs Aircraft Engine Co., Malcolm S. Clark, Ch. of Board of Directors.

Chevrolet Motor Div., Charles E. Wetherald, retired. Hugh Dean, General Mfg. Mgr., succeeding Mr. Wetherald.

Briggs Clarifier Co., E. Digges La Touche, Adm. Field Service Engineering Staff.

Bendix Aviation Corp., Leo A. Santry, to staff, Bendix Products Div.

G. M. Glannini & Co., Inc., A. J. Klose, Vice-Pres. and Chief Engineer.

The Firestone Tire & Rubber Co., V. D. Kniss, Mgr. Tire Div.; E. H. Holman, Mgr.

Truck Tire Div. and R. A. Schlarb, Mgr., Tractor Tire Sales Dept.; A. T. McGrath, Div. Mgr. Mfgs. Sales Dept.

Willys Export Corp., Leonard Vandersall, Field Rep.

The Glenn L. Martin Co., William J. Turnbull, Asst. Director of Procurement. Harry T. Rowland, elected 1st Vice-Pres.

Lear, Inc., William J. Perfield, Chief Engr., Mechanical Div.

E. I. du Pont de Nemours & Co., Thomas L. Hines, Gen. Asst. Mgr., Cellophane Div.

The B. F. Goodrich Co., Ray S. Jenkins, Gen. Supervisor, all Field Recap Plants.

Boots Aircraft Nut Corp., Col. Jay Boots, Chairman of Board.

The Timken Roller Bearing Co., Tracy V. Buckwalter, retired as Chief Engr. and Vice-Pres.

United Aircraft Corp., Chance Vought Div., John J. Hospers, Sales Mgr., William H. McCarthy, Field Service Mgr.

Ramsey Accessories Mfg. Corp., Charles

A. Marian, Jr., Sales Mgr., Field Div. ACF-Brill Motors Co., Carl L. Hecker, General Works Mgr.

Ford Motor Co., John F. Connors, Jr., Asst. Mgr., Washington, D. C. Branch.

United States Rubber Co., Tire Div., Watson L. Ford, Chief Field Engineer; Raymond A. Blake, General Service Mgr., Tire Engineering and Service Dept.; Howard W. Kelsey, Sales Promotion Mgr., General Products Div.

Packard Motors Car Co., L. W. Slack, Vice-Pres. and Gen. Sales Mgr.; H. J. Ferry, Vice-Pres. and Sec.-Treas.; G. C. Reifel, Vice-Pres. of Mfg. and E. C. Hoelzle, Vice-Pres. and Comptroller.

Buick Engine Plant, Jesse L. Powers, Supt.

Tyson Bearing Corp., George E. Wetzel, Industrial Relations Mgr.

Towmotor Corp., Ray E. Madden, District Sales and Service Rept.

Westinghouse Electric & Mfg. Co., George G. Main, Asst. Secretary and Treas.

Chrysler Corp., Dodge Truck Div., E. J. McPhee, Plant Mgr. Dan B. Mooney, Regional Mgr., Dodge Div.

Bristol Co., C. E. Mason, Technical Director.

Mack Trucks, Inc., Harry Bernard, Director of Service and Service Engineering.

Consolidated Vultee Aircraft Corp., Resignation of Tom M. Girdler, Chairman of Board.

Pontiac Motor Div., Garret W. Arnold, Asst. Service Mgr.

Aeronautical Chamber of Commerce, John E. P. Morgan, Executive Director; Harvey F. Stowers, Special Asst. to the President.

Air Associates, Inc., John C. Harrower, Vice-Pres. Charge of sales and engineering.

Warren City Mfg. Co., Subsidiary of Graham Paige Motors, Brice R. Freeman, Director of Industrial Relations.

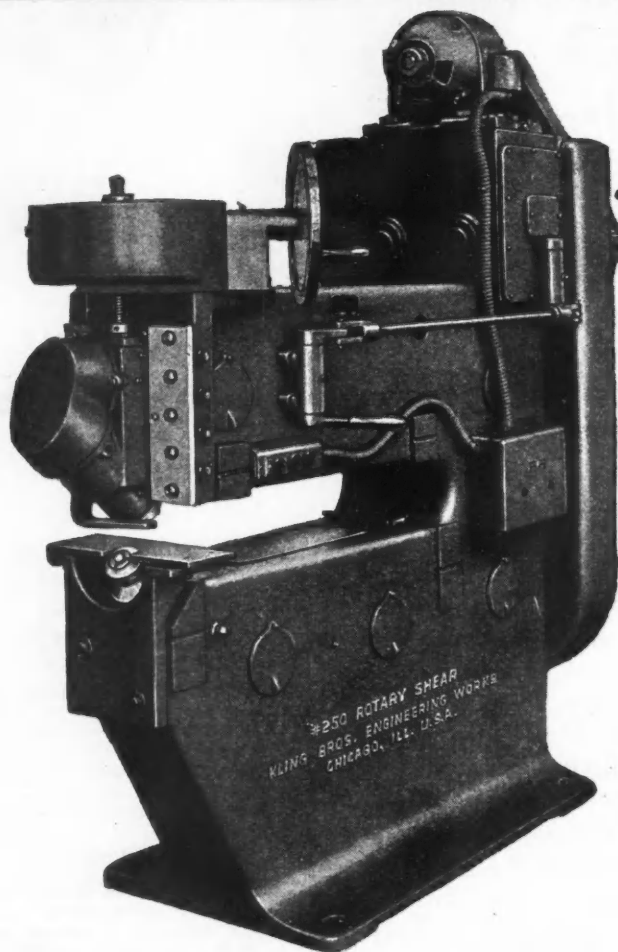
Mack-International Motor Truck Corp., John H. Middlekamp, Mgr. General Bus Sales Dept.

A. O. Smith Corp., Lloyd B. Smith, elected Vice President and Member of Board.

American Chain & Cable Co., Inc., J. H. Rose, Asst. Sales Mgr.

The Weatherhead Co., Otto G. Schwenk, Comptroller.

The Atlantic Refining Co., H. G. Schad, vice-pres.



PERFORMS A WIDE RANGE OF OPERATIONS!

The Kling Rotary Shear does a great variety of jobs—and does them quickly, efficiently, and better. Saves valuable space and manpower because of its manifold operations. Does the following types of work. (1) Cuts circles (2) Cuts straight lines (3) Cuts rings—small and large radii (4) Makes flanges (5) Joggles and offsets (6) Cuts odd shapes (7) Bevels of any angle (8) Cuts reverse curves (9) Beads & U's (10) Cuts holes without cutting in from the edges.



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Write today for free Bulletin No. 245. Sent without obligation or cost.

KLING BROS. ENGINEERING WORKS

1318-A5 No. KOSTNER AVE., CHICAGO 51, ILLINOIS

EXPORT DEPT., 1111 SO. FERRY BLDG., NEW YORK 4, N. Y.

New Quarters in Chicago For Clawson & Bals

Clawson & Bals, Inc., has recently completed moving its general offices and service department to 2508 S. Michigan Ave., Chicago.

The new quarters are located in the central automotive district and are also much larger and more efficient.

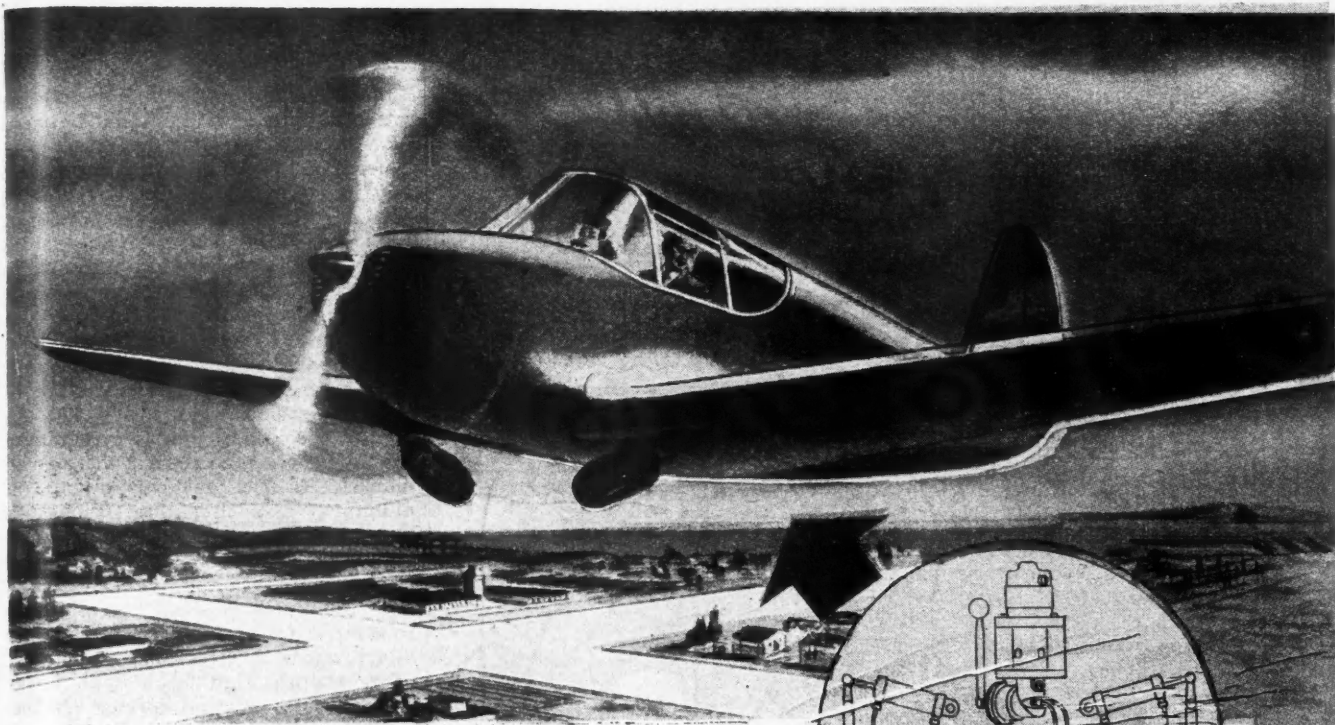
The space thus vacated in the factory at 4701 W. Lake St. has already been put to use for expanded production facilities.

Bendix Program for Personal Plane Radio

The Bendix Radio Division of Bendix Aviation Corp. has established a separate engineering and sales organization in Baltimore, Md., to coordinate development, manufacture and marketing of a line of efficient, low-cost radio communications and navigation equipment for personal planes.

O. B. Dahm Appointed

The Allied Cement & Chemical Corp., Lynn, Mass., has appointed O. B. Dahm, St. Louis, Mo., as its sales representative in the St. Louis territory.



"Gear up" with ADEL

New Power Packages for Light Planes

Designed specifically for the private plane, the new ADEL power package actuates retractable landing gear mechanisms, wing flaps and similar mechanical devices.

A compact unit, easily mounted in small space near the pilot, its electrically driven pump delivers fluid under 300 psi pressure at the rate of .40 gpm with a power requirement of only 298 watts at 12 volts. Its energy capacity is considerably in excess of normal needs of the private plane. Simple to install, it is low in cost and requires a minimum of maintenance for long, trouble-free service.

In this Power Package, ADEL brings to private flying the experience and skill gained in years of manufacturing hydraulic equipment for nearly every leading military and transport plane—tens of thousands of units which have been service tested under every conceivable condition in all parts of the globe.

For full information and technical data write the ADEL office nearest to you.

ABOVE—One of a series of ADEL Power Packages. It comprises an electric gear type fluid pump, visual reservoir, adjustable pressure relief valve, thermal relief valve, a cylinder by-pass valve, 4-way selector valve connected to manual control. Only 4 fittings required to connect. Overall size 4" diameter, 9 3/16" high. Weight filled 4.875 lbs, empty 4.5 lbs.

LOOK TO ADEL FOR PRODUCTS OF *Design Simplicity AND Dependability*

ADEL

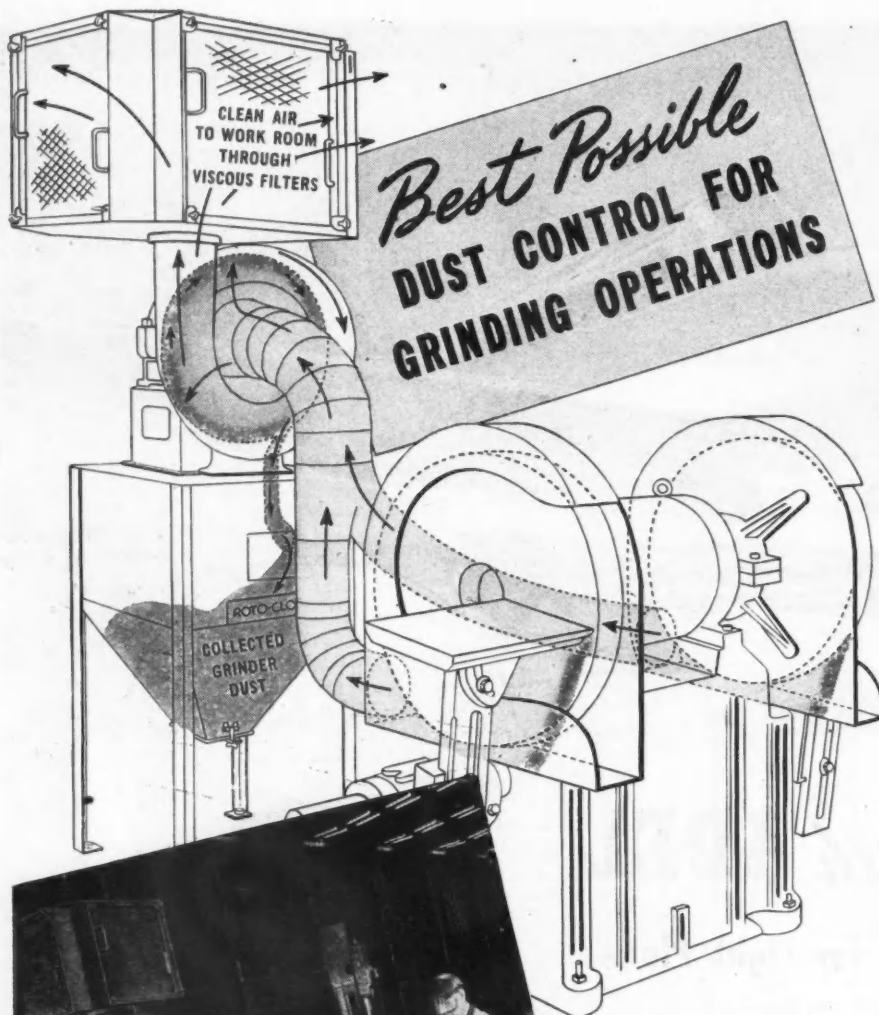
Trade Mark

ADEL PRECISION PRODUCTS CORP.
Burbank, Calif. • Huntington, W. Va.

Offices: Seattle 1, Washington; Dayton 2, Ohio; Detroit 2, Michigan; Hagerstown, Maryland; Baltimore 1, Maryland; New York 20, N.Y.

In Canada: Railway and Power Engineering Corporation, Limited

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Viscous filter aftercleaners mounted on the Roto-Clone exhaust allow cleaned air to be recirculated to the workroom.

The phantom view of the Type D Roto-Clone shown above illustrates the simplicity of exhaust ducts and hood arrangement and the ease with which it collects grinder dust. A Roto-Clone dust control system may be either an individual unit serving a single isolated dust producing operation, or it may be of the central type with main duct and branch connections to a number of dust sources.

The proven dynamic principle employed by the Roto-Clone results in a higher percentage of collection of the very small particles and its efficiency is unaffected by changes in air volume or operating speed. Its construction is sturdy and resists the abrasive action of metal dusts, thus assuring long life and freedom from servicing. Send for Bulletin No. 272.



AMERICAN AIR FILTER CO., INC.
Incorporated
449 CENTRAL AVE., LOUISVILLE 8, KENTUCKY
In Canada: Darling Brothers, Ltd., Montreal, P. Q.

ROTO-CLONE
FOR ALL GRINDING OPERATIONS

Scrap Aluminum Converted To New Metal

SCRAP aluminum can now be converted into new aluminum by means of a process developed by research engineers of the Aluminum Ore Co. working in conjunction with engineers of the Air Technical Service Command and the Redistribution and Salvage Office of the Army Air Forces. The process is particularly interesting at this time, according to Brigadier General F. M. Hopkins, Jr., Redistribution and Salvage officer of the Army Air Forces, in that it may permit the disposal of crashed, war weary and technically obsolete airplanes in a manner that will not make them a drag on the market. In the past, to salvage the aluminum in such planes, it has been necessary to sort out the other materials in the plane's construction and melt down the aluminum. The metal thus obtained was of limited value because it was a mixture of aluminum alloys, more or less contaminated by other metals that could not be removed by commercial sorting methods.

The aluminum obtained from the newly developed process of the Aluminum Ore Company, a subsidiary of the Aluminum Co. of America, is for all intents and purposes, the same as aluminum manufactured from bauxite. It can be used anywhere that any other commercially pure aluminum can be used. The process centers around a novel way the Aluminum Ore Co. has developed for returning the scrap aluminum to the Bayer Process, a process used in the manufacture of alumina from bauxite. The alumina or aluminum oxide is an intermediate product which is electrolytically reduced to metallic aluminum.

In the Alcoa process obsolete planes are introduced into a bath of caustic soda. The caustic soda dissolves the aluminum in the planes, while any steel nuts and bolts, copper piping, bronze bushings, rubber, or other non-aluminum parts are not attacked by the caustic and remain in solid form. In the case of the aluminum alloys, the alloying elements are not attacked by the caustic. They, too, remain in the sludge as finely divided particles. The scrapped plane is thus taken apart chemically instead of by hand labor.

The solid impurities are removed from the solution in filter presses, and the liquor passing through the filters is returned to the Bayer Process to be manufactured into pure aluminum oxide. This is done by pumping the liquor into precipitating tanks as high as 5 or 6 story buildings and allowing it to stand and cool. In time, crystals of aluminum hydroxide begin to settle out. These crystals are removed and washed to free them of caustic soda which is again returned to the process. The aluminum hydroxide crystals are then heated white hot in large rotating kilns to drive off the chemically combined water and leave commercially pure aluminum oxide, or alumina.



LONG...

THE CLUTCH THAT CAN TAKE IT!



The same clutch dependability which tanks and other military units *must* have, is assured for cars, trucks, buses and tractors. Long clutches combine ease and flexibility

of operation with heavy-duty construction which means long, trouble-free service under the most severe operating conditions.

LONG MANUFACTURING DIVISION, BORG-WARNER CORPORATION
DETROIT 12, MICHIGAN - WINDSOR, ONTARIO

LONG

CLUTCHES • RADIATORS • OIL COOLERS

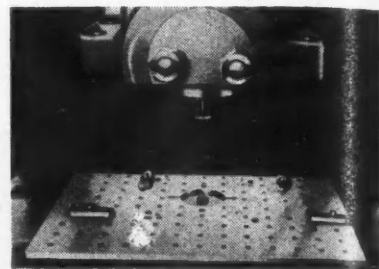


New Production Equipment

S. B. WHISTLER AND SONS, INC., Buffalo, N. Y., have brought out a single hole perforator which handles materials to and including ¼-in. thick mild steel. The complete Whistler single hole perforating equipment consists of an alloy steel hardened punch holder, 4 hardened and ground punch adaptor rings to accommodate punches

from 1/32 in. to 1½ in., semi-tempered steel die shoe, gauge plate 16 in. by 24 in., 4 hardened and ground die adaptor rings to accommodate die bushings to 1½ in., and four gauges for positioning sheet to be perforated.

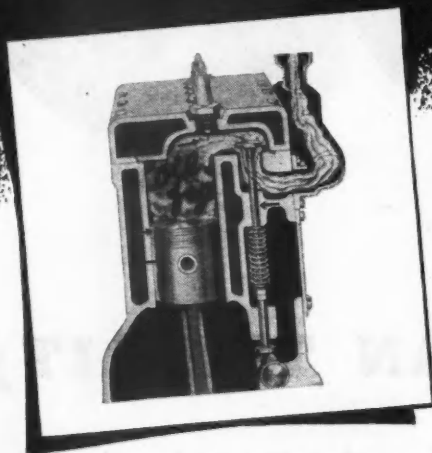
Punches, dies and strippers are not included but these parts, in standard sizes and shapes, same as those used



Whistler single hole perforator set

with the Whistler adjustable die units, can be supplied by the manufacturer.

advise motor users:



**Keep Valves, Guides,
Upper Cylinder,
Pistons, Rings**

**Oiled
thru
Carburetor**

by treating your gasoline with

LUBRI-GAS

there's NOTHING else like it!

No mechanical system has ever been invented that assures constant, adequate lubrication of valves, guides, upper cylinder, pistons, rings. That is why sticky valves, burned and pitted valve seats, worn rings, and carbon and gum accumulations in upper cylinder are usually the first symptoms of motor trouble. Lubri-Gas Laboratories have developed an exclusive method of chemically processing 40 SAE lubricating oil, so that it enters the combustion chamber, through the carburetor, as an oil fog, and coats all upper cylinder parts with a film of clean oil. The results of this better lubrication are more power, more mileage per gallon, more pep, less wear and repair, freedom from carbon and gum and prevention of overheating and oil pumping. Now when it is so important to keep equipment in operation and out of the repair shop, LUBRI-GAS is indeed a God-send!



Send for Free Lubri-Gas File. Contains complete information about this modern motor fuel treatment.

LUBRI-GAS

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Chicago 1, Ill.

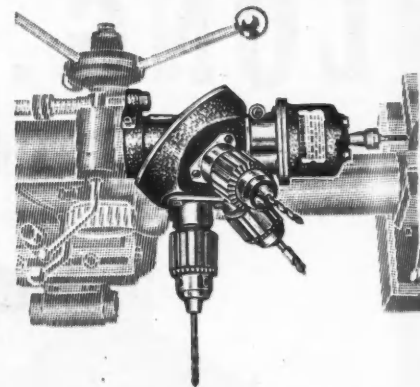


Cleans and Lubricates as It Powers the Motor

A TAPPING unit to attach to the Quadrill turret attachment for drill presses is being offered by Chicago Drillet Corp., Chicago, Ill.

The new unit sold under the trade name Quad-Tapper, is a high-speed, self-reversing tapping attachment having a ¼-in. capacity. It is interchangeable with any of the four spindle assemblies of the Quadrill, and may be mounted in any one of the four positions.

Strain and wear are said to be minimized, and torsion eliminated, through the three-point balanced, heat-treated gear reversing mechanism

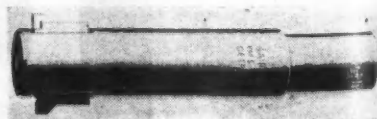


Quad-Tapper tapping attachment

which distributes the pull through three intermediate gears. Reverse speed is twice the forward speed. Tap idles in tapping direction, not in the "backing out" direction.

THE Gairing Tool Co., Detroit, Mich., has developed a quick-detachable cutter block which provides self centering, positive locking, quick inserting of block in boring bar and easy removal, without the aid of locating holes or screws, keys, wedges or taper pins.

The block, containing the adjustable blades, is made to engage both sides of
(Turn to page 60, please)



Gairing boring bar with quick detachable cutter block.



Machine-time-out is time lost . . . money lost. The answer to that one, as learned by the aviation industry early in the days of fighter plane construction, is going to help all industry.

Today complex electrical circuits and operating units, in the plants as well as the planes, can be disconnected and reconnected in a few seconds time.



Interchangeable units can be replaced quickly. In the future, builders of electrical and electronic equipment of many types will use this improvement in design to their customers' advantage.

A typical Amphenol connector shown above, is being used all over the world by the Army, Navy and Air Corps under all kinds of conditions. Connections are absolutely secure! Shock or vibration cannot break them but they may be disconnected in an instant. Amphenol connectors are being made in water-proof, gas-proof, pressure-proof and other types—others to mate with British equipment, still others for U.H.F. use.

If you're design-conscious be sure to get Amphenol-conscious. Write for descriptive catalog sheets.

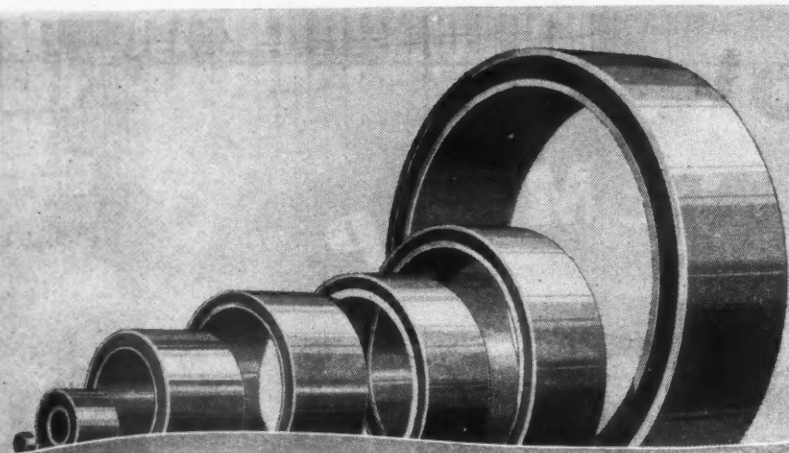
AMERICAN PHENOLIC CORPORATION
Chicago 30, Illinois

In Canada • AMPHENOL LIMITED • Toronto

Connectors (A-N, British, U.H.F.), Fittings, Cable Assemblies, Conduit, U.H.F. Cable, Radio Parts, Synthetics for Industry

May 15, 1945

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WIDE RANGE OF SIZES *Torflex FLEXIBLE BEARINGS*

Torflex Bearings are not only unique in design and construction but they embody exclusive patented features which are more than just talking points.

Torflex Bearings consist of a seamless tube of rubber which has been stretched between two concentric metal tubes assuring high radial pressure which provides the required adhesion between the rubber and metal. Torflex Bearings take axial, torsional and radial loads. They absorb vibration, provide flexibility for cushion and misalignment, transmit torque, suppress noise, eliminate wear and friction and are being made in a wide range of sizes to carry loads from ounces to tons.

Harris Products Company pioneered in this field and for years, Torflex Bearings have been widely used in automobiles, tractors and industrial equipment. Today as in the prewar days, Torflex Bearings still lead, and are being used in combat tanks and for various types of war equipment. Our engineers over a period of years, have gained an enviable reputation in solving many difficult problems in connection with various types of equipment, by the application of Torflex Bearings thereto.

You may have some problem—current or postwar, that Torflex Bearings could solve better than anything else. Drop us a line and we'll be glad to work with you.

**LOW COST...REDUCES NOISE
HARRIS PRODUCTS CUSHIONS SHOCK...
• COMPANY • STOPS VIBRATION**

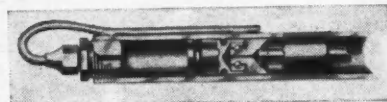
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Torflex BEARINGS
Torflex COUPLINGS
**HARRIS COMPRESSED
RUBBER BEARINGS**

HARRIS
PRODUCTS COMPANY
CLEVELAND 4, OHIO, U. S. A.

the precision ground flats on the bar where it centers itself. When located, the cutting thrust pressure is evenly distributed against the back and bottom of the slot.

Blocks are fitted with high speed steel, cast-alloy or tungsten carbide tipped blades.

NEWTON MANUFACTURING CO., Los Angeles, Cal., announces a new bar feed made in seven sizes to take bar stock from 6-ft. to 11-ft. lengths. The Newton bar feed is a complete unit, including stands, seamless tube, pressure regulator and piston.



Newton bar feed

The air line connects to the pressure regulator, which delivers the desired pressure to the bar end of the stock tube and actuates the piston, which pushes the stock into the lathe and against the stock stop under uniform pressure.

Noiseless stock feeding is accomplished by the piston which centers the stock and turns with it, thereby holding it away from the feeder tube.

LE MAIRE TOOL & MFG. CO., Dearborn, Mich., has designed and built a special 2-way trunnion type machine for drilling, chamfering, and reaming yokes for universal joints. The machine is capable of accommodating sizes ranging from 7/8-in. to 1 1/2 in. in diameter. By reaming from two directions each tool does half the work.

The machine consists of a manually operated 6-station trunnion mounted



LeMaire trunnion type machine

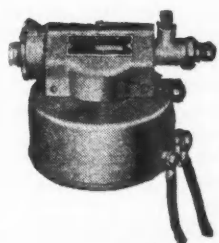
on a fabricated base on which are mounted two standard LeMaire self-contained slide-type hydraulic units. Change gears provide various spindle speeds for the 5-spindle drill heads. The reamers are driven by a special quill type spindle built in the trunnion, with power transmitted from multiple head through a flexible drive.

ADDDING to its present line of Long-Lyfe blast nozzles, American Foundry Equipment Co., Mishawaka, Ind., is now in a position to supply a complete line of nozzles using Norbide borium carbide inserts. Another feature is the jacketing of this insert in
(Continued on page 126)

— **DRIVERS and
EQUIPMENT with
the SAFETY
of CONTROLLED
BRAKING POWER**



VARI-LOAD ELECTRIC BRAKES

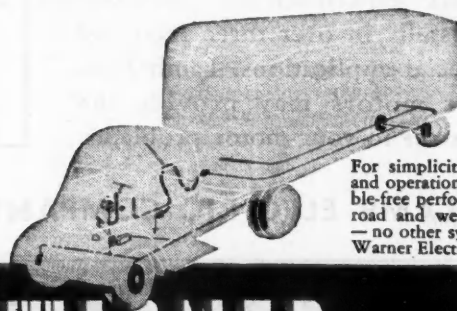


**FOOT PEDAL PRESSURE
CONTROLS BRAKES ON
BOTH TRACTOR AND
TRAILER**



**NEW WARNER CONTROLLER
NOW AVAILABLE FOR PRESENT
TRAILERS HAVING WARNER
ELECTRIC BRAKES**

The new Warner Controller—simple and compact—synchronizes the hydraulic brakes on tractor with the Electric Brakes on trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth foot-touch tractor-trailer braking under all conditions—eases driving strain—assures greater safety. Controller is easily and quickly fitted into hydraulic brakeline. See your Warner dealer about changing over your present equipment.



For simplicity of installation and operation—for safe, trouble-free performance under all road and weather conditions—no other system can match Warner Electric Brakes.

**WARNER
ELECTRIC BRAKES**

Labor-Management-Policy Holds Employee Turnover to 4.5 per cent

*Monroe programs with 2000 on the
roster reduces absenteeism to 1.4 per cent*

THROUGH an effective system of employee committees, Monroe Auto Equipment Co., Monroe, Mich., has reduced absenteeism to about 1.4 per cent a month and employee turnover for all reasons, including the draft, to approximately 4.5 per cent. This record is only one of many fruits harvested

from the company's longstanding labor-management policy which leans heavily on personal relationships between top management and the men at the machines. Since January, 1943, dollar volume of production has gone up 175 per cent, and the company, which is unionized, has never had a strike or

threat of strike. It now is awaiting a fourth white star for its Army-Navy "E" pennant.

When the employee committee suggestion was broached by the union in April, 1942, Monroe Auto officials, Brouwer D., William D., and Charles S. McIntyre, quickly accepted. A group of four workers on each shift stays on to check absentees on the following shift. They then make personal calls on absentees to determine why they are not on the job. The embarrassment of being found loafing, coupled with the social pressure possible in a small community, was found very effective in reducing absenteeism from 16 per cent to 1.4 per cent a month in 12 months.

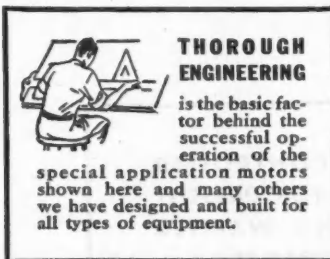
The management has instituted courses of instruction for the foremen in order to insure smooth relations. Classes meet weekly and cover such subjects as starting new men off right, control of temper, waste, grievances, mistakes, safety, handling temperamental workers, fairness, gossip, encouragement, playing favorites, responsibilities, issuing instructions, planning, quitting early, and many others.

Many innovations have also been instituted to bolster morale and increase individual efficiency. These include: relaxation of smoking rules where possible, free coffee on tap at all times, free vitamin pills, private nurses in addition to the regular first-aid department, piped-in music and news for 20 minutes of each hour, personal and public birthday greetings to each "associate," counselors on personal problems, etc. The company feels it has a good right to claim origination of the payroll deduction plan for bonds, since it set up this system six months before it was adopted by the Treasury Department.

With the recent acquisition of the Stoner-Maurer Co. plant and operations, Monroe employment rolls now are up to about 2000 persons. Part of the plant space will be used to continue production of an improved line of materials-handling equipment, and the rest will be used to expand Monroe's shock absorber and tractor seat departments. Postwar products will include tractor, truck, and bus seats; shock absorbers, including improved models for heavy trucks and freight cars; metal-plated plastics; a rubber injection machine that makes casting possible in three minutes; hydraulic equipment for aircraft, and other automotive and railway equipment. All of those developments have been publicized to the employees to assure them of postwar employment and to keep them on the job. The company also has promised jobs to its returning servicemen, offering to re-employ them at any time within six months after their discharge, twice the period required by law.



A thoroughly dependable motor is the first step in meeting the high standards of performance that will be demanded of tomorrow's products. Backed by 30 years' experience and used successfully in over three thousand special applications, Lamb Electric motors may provide the answer to your motor problems.



THOROUGH ENGINEERING

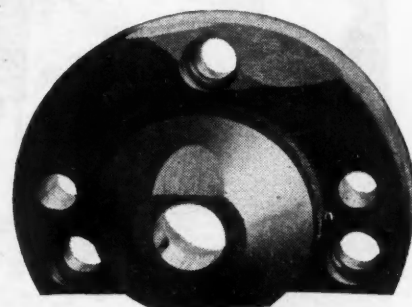
is the basic factor behind the successful operation of the special application motors shown here and many others we have designed and built for all types of equipment.

THE LAMB ELECTRIC COMPANY • KENT, OHIO



SPECIAL APPLICATION
FRACTIONAL HORSEPOWER MOTORS

Buy More Bonds



A die of Crucible's "Airdi" No. 150 steel (Chrome-moly-vanadium) goes into the Vapocarb-Hump Hardening Furnace at McGraw Electric Co. Right: Hardened and Homotempered die.

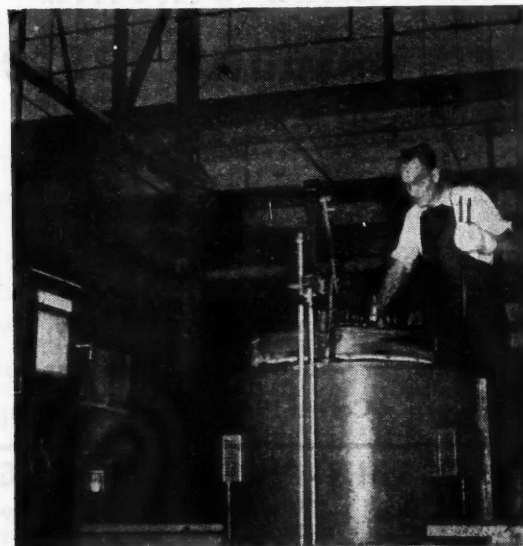
NO SCALE --- NO DECARB --- IN TOASTMASTER'S VAPOCARB-HUMP HEAT-TREAT

This coining and blanking die is typical of the dies and die parts being hardened by the Vapocarb-Hump Method and tempered by the Homo Method at Toastmaster Products Division of McGraw Electric Company, Elgin, Illinois. The die's smooth surface and carefully-controlled structure are typical of *all* parts treated in L&N all-electric furnaces.

There's no guesswork in these methods—all variables are under control. In the Vapocarb-Hump, protective Vapocarb gas completely envelops the work and refuses to allow soft spots due to vapor pockets or adherent scale. A Micromax Recording Controller prevents the normal furnace head (normal temperature difference between work and furnace) from being exceeded; it reduces the heat when work enters the critical—increases it later as desired.

The findings of two thermocouples—one detecting *work* temperature, the other detecting *furnace* temperature—appear on the chart of the Micromax Recording Controller. This complete temperature picture, plus the location of the critical range, enable the heat-treater to heat accurately and to find the quench point which will give "perfect" surface, correct structure, and long tool life.

An L&N engineer will gladly see you regarding a specific heat-treating problem, or will send a Catalog, as you prefer.



Companion to the Vapocarb-Hump, this L&N Homo-Tempering Furnace is a quick, clean, and accurate means of stress-relieving hardened parts. The furnace comes to temperature rapidly—has a large capacity. The heat-treater simply sets the Micromax Controller for the temperature which will give best results.



LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

Jrl Ad T-620(19)

May 15, 1945

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CENTERED DRIVING means faster fastening

A Corbin-Phillips Recessed Head Screw holds the end of the driver *firmly centered* in a four-point grip of steel. This gives you non-slip operation, permitting faster fastening, with each screw driven home stronger, deeper, firmer . . . making for greater security, better production, lower cost.

Whether you drive your screws by hand or power, use
S-1 Corbin-Phillips *Centered Driving* for better profits!

CORBIN-PHILLIPS AND CORBIN SLOTTED

Wood Screws, Machine Screws, Hardened Sheet Metal Screws, Self-Tapping Machine Screws, Stove Bolts, Aircraft Screws to government specifications . . .

Also — Steel Drive Screws, Lag Screws, Cap Screws, Set Screws, Hex Semi-Finished Nuts, Machine Screw Nuts, Escutcheon Pins and Chain.

THE CORBIN SCREW CORPORATION
The American Hardware Corp., Successor
NEW BRITAIN, CONN. Warehouses: New York, Chicago



Screws Nuts Chain

1944 Engine Production Tops '43 Total

By Marcus Ainsworth

SHIPMENTS of internal combustion engines during 1944 amounted to 2,619,615 an increase of 23 per cent over the 2,131,775 produced during 1943. These data cover actual shipments of all engines produced in the United States with the exception of aircraft propulsion engines, marine Diesel engines and Diesel and gas engines of 750 rpm or less.

Through the facilities of the Automotive Division, War Production Board we have, for the first time, a detailed account of engine production in the United States. Previous reports released through the Census of Manufactures listed those engines built by manufacturers producing engines only and did not include the engines produced by vehicle manufacturers for use in their own vehicles, whether they be cars, trucks, buses or tractors. While this report, covering the two war years of 1943 and 1944 cannot be accepted as a guide for peacetime production when over five million engines were produced for motor vehicles alone, it is, nevertheless, a step in the right direction and it is to be hoped that the precedent established with its inauguration will result in a continuity of such releases when we are once again in peacetime production.

Of the 2,619,615 engine shipments during 1944, air cooled engines numbered 675,211 or 25.7 per cent of total engines produced. While it is quite possible that there may be a few tank engines of considerable horsepower included in this category of air cooled engines, by far the great bulk of them will be in the low horsepower class with the great majority under ten horsepower and a small percentage from 25 to 35 horsepower. Their uses are multiple and war time needs have been largely responsible for the great numbers produced, but it is quite evident that normal conditions will also create a large market for such power plants. There was a decline in shipments of these engines during 1944 from the 708,934 shipped in 1943 when air cooled engines represented 33.2 per cent of all engines.

Liquid cooled engine shipments amounted to 1,792,790 or 68.5 per cent of all engines during 1944 as compared with 1,301,129 or 61.1 per cent of total engines produced during 1943.

Diesel engine shipments for other than marine use and over 750 rpm amounted to 151,614 during 1944 and 121,712 in 1943. Their proportion of total engines produced was 5.8 per cent for 1944 and 5.7 per cent for 1943.

A summary of this release follows:

Shipments of Internal Combustion Engines				
	1944		1943	
	Number	% of Total	Number	% of Total
Air Cooled	675,211	25.7	708,934	33.2
Liquid Cooled	1,792,790	68.5	1,301,129	61.1
Diesel	151,614	5.8	121,712	5.7
Total	2,619,615	100.0	2,131,775	100.0

N-A-X

HIGH-TENSILE STEEL

GREAT STRENGTH—HIGH DUCTILITY

These Two Important Properties
Are Joined in One Great Steel

There are many steels that offer high yield strength; there are others that provide good ductility. It is the combination of both desirable properties in N-A-X High-Tensile Steel that makes possible exceptional economies in the design and fabrication of stressed parts. N-A-X High-Tensile Steel is proving its worth in varied war equipment and in essential civilian products . . . bringing to manufacturers the advantages of easy cold-forming, excellent weldability, great strength, and high resistance to impact, wear and fatigue. It is one of America's most *useful* steels.

N-A-X ALLOY DIVISION

GREAT LAKES STEEL

Corporation

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UNIT OF NATIONAL STEEL CORPORATION

GREAT STEEL
FROM
GREAT LAKES

N-A-X 9100 SERIES STEELS for shallow or medium hardening requirements, and **N-A-X X-9100 Series Steels** (molybdenum-bearing) for depth hardening requirements, provide an all-purpose analysis to yield properties in both carburizing

and constructional ranges of carbon.

N-A-X ARMORPLATE, used in practically every type of landing craft and in scores of combat vehicles, gives evidence of the strength and ruggedness that characterize N-A-X low-alloy steels.

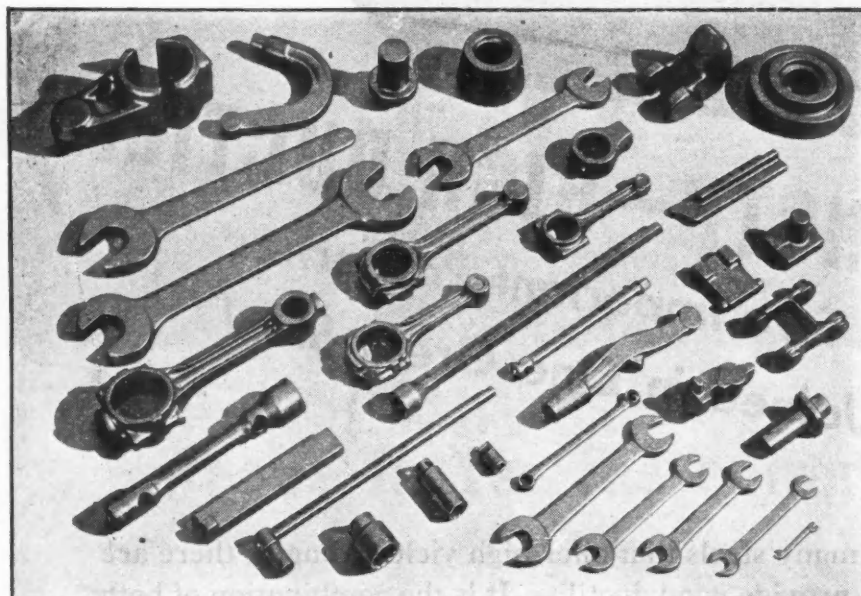
New Products for Aircraft

Hydraulic System Equipment

A complete line of equipment for 3000 psi hydraulic systems has been announced by Pacific Division, Bendix Aviation Corporation, North Hollywood, Cal.

Twenty units are in production or soon will be available. These include

5-in. 7½-in. and 10-in. pressure accumulators, five sizes of check valves, actuating cylinders, electric operated 4-way selector valve, flow equalizer, hand pump, power brake valve, pressure regulator, one-way and two-way restrictor valves, sequence valve, and ¾-in. and ½-in. T. S. way selector valves.



Herbrand PRECISION FORGINGS

Upset or Drop Forged--Any Shape or Size up to 200 lbs.

You who use forgings in war production work won't have a problem of faulty forgings if the job is being done by Herbrand. Our expert hammer-smiths, who have made forging their life business, maintain uniform dimensions and close tolerances producing forgings which are free from defects...Since our organ-

ization was founded in 1881, Herbrand has never lost sight of the importance of producing quality products conforming to exacting specifications.

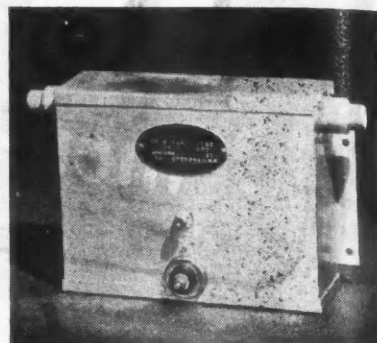
Today the counsel of the Herbrand engineering staff is available to help solve present war production problems, or for post-war planning . . . Your inquiries are solicited.



THE HERBRAND CORPORATION
FREMONT, OHIO

Ignition Transformers for Aircraft

Three 115-volt, 400-cycle ignition transformers, designed to provide a high-voltage arc for igniting fuel in gasoline-fired, aircraft-cabin heaters and de-icers, have been added to the line of the General Electric Company Schenectady, N. Y. The units are shielded and filtered to minimize radio interferences over all wave bands from 110 kilocycles to 200 megacycles.



G-E cabin heater ignition transformer

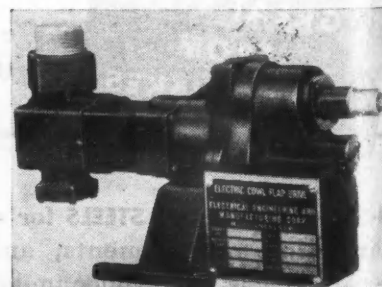
Two of the transformers, with an output capacity of 6000 volts each, are of the single-secondary type. The third has a double secondary, rated 6000/6000 volts for heaters with dual ignition or for two separate heaters with single-ignition systems.

The units are housed in plated-steel cases and all coils are imbedded in a specially developed high-melting-point, moisture-resistant insulating compound. They will operate over a wide range of ambient temperatures from -70 to 140 F. at altitudes from sea level to 45,000 ft.

New Cowl Flap Actuating Motor

Electrical Engineering and Mfg. Corp., Los Angeles, Cal., is making a cowl flap actuating motor. Designed specially for cowl flap actuation on the Douglas A-26 attack bomber, and custom built throughout to combine an electric motor, gear reduction and control unit to fit awkward mounting conditions and limited space. The cowl flap installation is necessary to maintain proper engine temperatures under varying conditions of minus 70 F. to plus 140 F. and from sea level to the op-

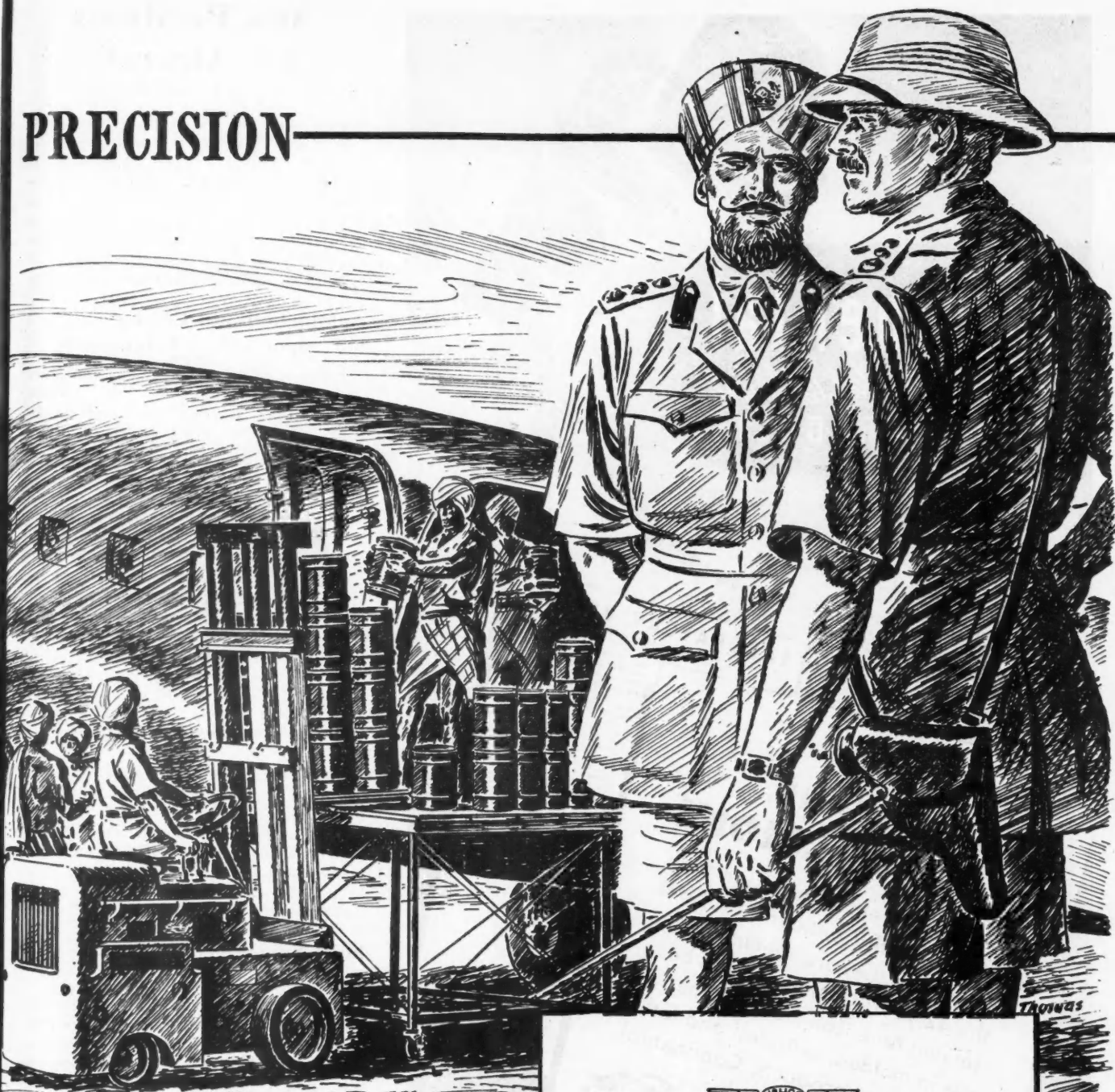
(Turn to page 72, please)



Cowl flap drive for A-26 attack bomber

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PRECISION




JACK & HEINTZ
Incorporated

air-tight, water-proof seal. Where conventional packing was good for six months, Jack & Heintz canning protects for a minimum of two years . . . in steaming jungles as well as in sub-zero cold.

This idea, like hundreds of other Jack & Heintz methods, has excellent peacetime applications—export marketing, for example. In the meantime, it will be used to guarantee delivery to our fighting men of all the precision, performance and long life built into vital aircraft equipment by Jack & Heintz.



gyro pilots, gyro flight instruments, magnetos, motors.

May 15, 1945

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

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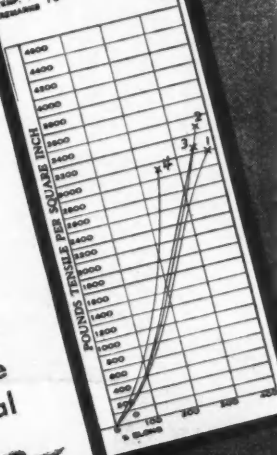
Molded, Extruded, Lathe Cut
RUBBER PRODUCTS

FOR A DOZEN,
a THOUSAND,
a **MILLION!**

• Manufacturers who design their products with Continental rubber parts know they are benefiting from the 42 years Continental industry. Specializing in molded, extruded and lathe cut rubber products, Continental can be relied upon for correct production from the most suitable materials—natural or synthetic.

LABORATORY REPORT

COMPOUND BN-80109E
RECD. 1-28-45 CURE TRAM. LONG
TESTED BY COOK
ME. 1" X 1/2" AGING
TEMP. 78° DAYS TENS. ELONG. SET



C

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CONTINENTAL RUBBER WORKS
ERIE, PENNSYLVANIA, U. S. A.

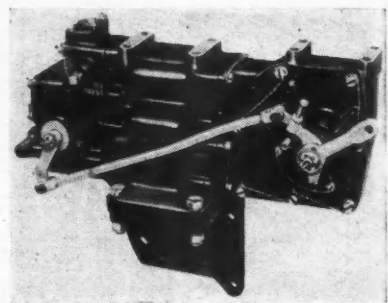
New Products for Aircraft

(Continued from page 68)

timum altitude of the Army A-26. The unit is completely self contained. Shaft output is 8 in-lb at 1200 rpm. Straight 8 to 1 gear reduction is provided for opening and closing flaps, with double reduction and worm drive to operate cams limiting travel of flaps. As furnished for use in a 28-volt system, this motor-actuator weighs 4 3/4 lb.

Automatic Boost Controls For Supercharger Engines

Eclipse automatic boost controls are designed for application to various single-stage, single-speed, and single-stage, two-speed supercharged aviation



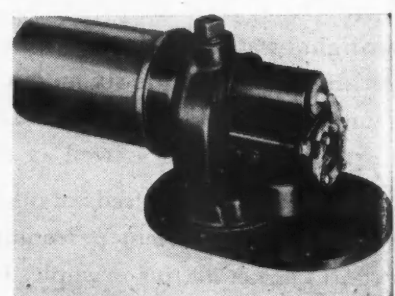
Eclipse automatic boost control

engines to protect the engines from detonation or overstress and to reduce pilot fatigue.

Due to military restrictions, design and engineering data on Eclipse automatic boost controls are available only to manufacturers approved by the U. S. Government.

Fully Submerged Water Injection Pump *

A fully submerged water injection pump for use on all types of aircraft has been brought out by the Romec Pump Co., Elyria, Ohio. It requires less than 1 1/2 in. of space outside the tank for mounting, and supplies water



Romec pump with supercharge connection

or water-alcohol mixtures vaporized in the combustion chambers. Special internal insulation and external contact insulation are said to solve corrosion problems. The pump is engineered for wide temperature ranges.

"Outdated!"... he cries



LOOK, VIDKUN, OUTDATING occurs only when men take recourse to
A BETTER WAY

Such as "Lincolnweld"... the New Automatic Shielded Arc Welding Process:

800% Faster Output with "Lincolnweld"



Product: Aircraft generator frames, by Jack & Heintz, Inc., Bedford, Ohio. "Lincolnweld" joins 8 rings $4\frac{3}{4}$ " long by $6\frac{5}{8}$ " o.d., $\frac{1}{2}$ " thick, by longitudinal weld in one pass, using copper back-up bar. Rings are then broken apart. Two brackets are welded to each ring as shown in inset. Girth welds are welded in one pass. Welds pass rigid X-ray—magnaflux and torque tests. "Lincolnweld" has boosted production of these frames 800%.

This is one of scores of operations on a wide variety of products which have been improved by "Lincolnweld." These include boiler drums, ship sections, motor frames, compressor tanks, heat transfer tubes, bearing shells, ship masts, fan housings, bending brake beds, gear blanks, structural steel and water heaters.

Find out how this *simplified* automatic shielded arc welding process can speed *your* output, improve *your* products and cut *your* costs. Descriptive procedure manual, Bul. 439, free on request.



THE LINCOLN ELECTRIC COMPANY • DEPT. Z-1 • CLEVELAND 1, OHIO

America's greatest natural recourse

ARC WELDING

New Products

Acid Pickling Inhibitor In Powdered Form

An organic acid pickling inhibitor in powdered form, designated Pennsalt PM-40, has recently been placed on the market by the Pennsylvania Salt Manufacturing Co., Philadelphia, Pa. This material is highly stable and is

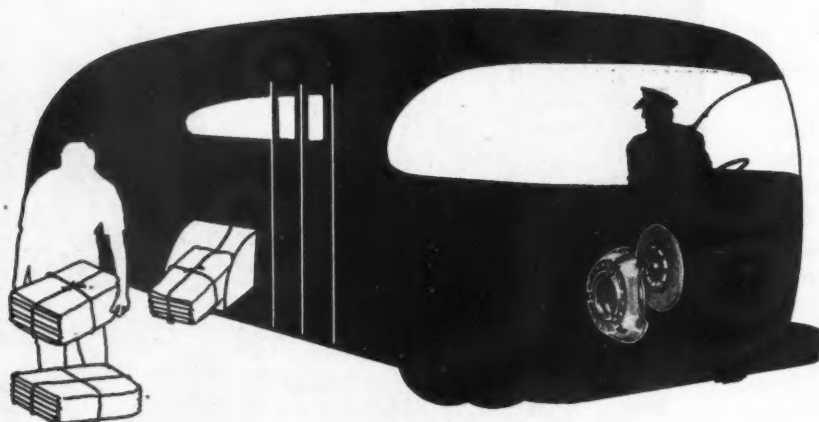
completely soluble in pickling baths of either hydrochloric or sulfuric acid. It contains 100 per cent active ingredients and is said to be highly effective at such low concentrations as 0.02 per cent to 0.10 per cent, by weight of the pickling bath. Concentrations may be varied to meet plant conditions, production rate, and quality of surface

desired. This material effects economies in both acid and metal, while minimum quantities of inhibitor are required. Due to high base metal protection, the acid is consumed principally in scale and rust removal with the result that the useful life of the bath is prolonged. Pennsalt PM-40 can be used in acid pickle baths prior to electroplating, galvanizing, and enameling, since it is free-rinsing and minimizes hydrogen absorption.

Universal Appliance Motors

Small Motors, Inc., Chicago, Ill., has placed on the market the SM-4 line of universal appliance motors. These motors are wound for any voltage from

PLAN Now TO GIVE YOUR PRODUCT BETTER POWER TRANSMISSION CONTROL



Don't wait until peace comes. Overnight, wartime destruction may turn to peacetime construction—and competition become keener, and more ruthless. Make sure that your products benefit from the latest clutch developments. Put the advantages of our unmatched transmission engineering experience and clutch manufacturing facilities into your new designs. Let our engineers show you why "ROCKFORD" — on your blueprints — means the most suitable power transmission control.

SEND FOR THIS HANDY BULLETIN ON POWER TRANSMISSION

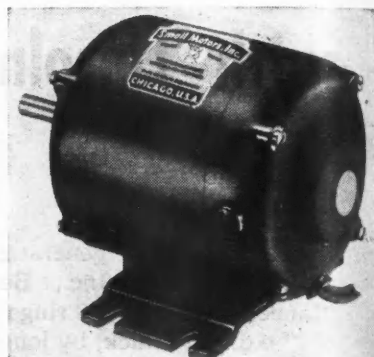
It shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications. Every production engineer will find help in this handy bulletin, when planning postwar products.



ROCKFORD CLUTCH [FORMERLY KNOWN AS DRILLING MACHINE] DIVISION

315 Catherine Street, Rockford, Illinois, U.S.A.

BORG-WARNER CORPORATION

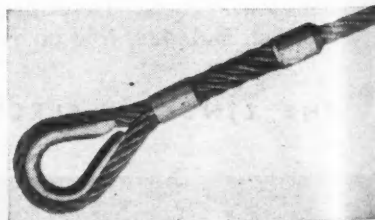


SM-4 fractional horsepower motor

six to 250, and operate on alternating or direct current. They are made to order for speeds from 2000 to 10,000 rpm with precision ball bearings, and from 10,000 to 20,000 rpm with oilless sleeve bearings. Special models are built with speed-reduction gearing or with governor-controlled speed reduction. Various capacities, from 1/50 to 1/10 hp are available.

New Splice Develops Full Strength of Rope

American Chain & Cable Company, Inc., Bridgeport, Conn., has disclosed a new method for splicing wire rope into slings or various assemblies. This



Acco-Loc Safety Splice

method develops a neater and more compact splice than is possible by the hand method. The splice is flexible clear to the terminal, and is said to develop 100 per cent of the rope's strength. The Acco-Loc Safety Splice does not distort the rope structure and so maintains equalization of stresses in all strands. (Turn to page 78, please)

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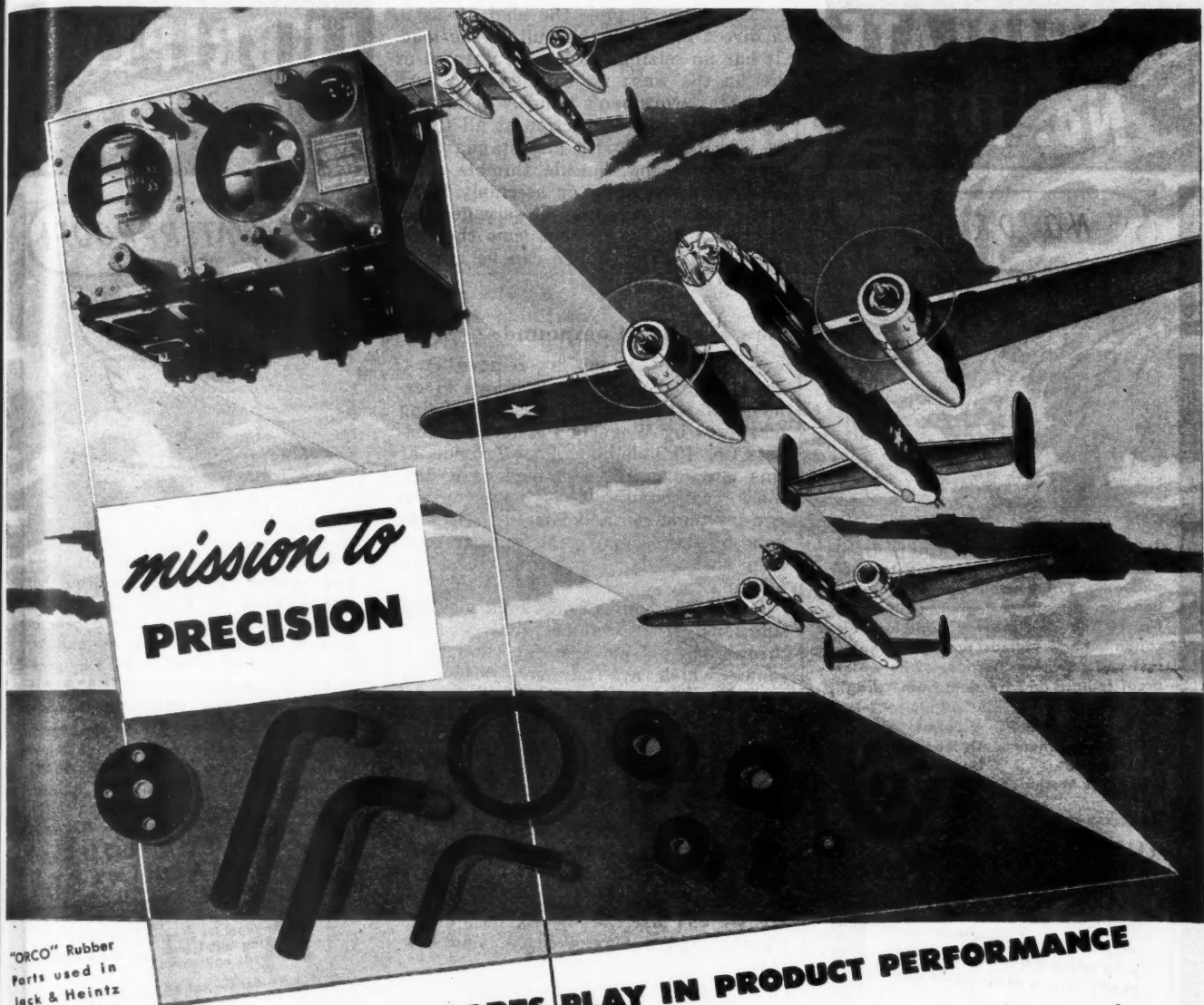
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TRIES



mission to
PRECISION

"ORCO" Rubber
Parts used in
Jack & Heintz
Automatic Pilot

THE PART THAT PARTS PLAY IN PRODUCT PERFORMANCE

● Mission of the automatic pilot is precision flight. Instantly, it detects and corrects the smallest deflection. It is a mechanical "nerve center" whose sensitivity to variations from a fixed course far excels that of the human brain.

"Anatomy" of the Automatic Pilot

1100 parts comprise the automatic pilot built by **JACK & HEINTZ, INC.**, for various types of military and commercial airplanes. Important elements of the automatic pilot are the rubber parts illustrated. Production of these vital parts to exacting standards is the respon-

sibility of The Ohio Rubber Company. It takes a completely qualified organization to fulfill such responsibilities successfully. It may be summed up in one word . . .

"Orco-Operation" . . .

which includes complete research, engineering, and manufacturing facilities in the fields of mechanical molded and extruded rubber and synthetic rubber together with modern processes for bonding rubber and synthetic rubber to metals and other materials. May we direct this versatility to YOUR requirements?

BRANCHES: DETROIT • NEW YORK • CHICAGO
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"ORCO-OPERATION"
THE OHIO RUBBER COMPANY • WILLOUGHBY, OHIO

LUBRIPLATE No. 105

NO DRAG!



This very smooth, light density (semi-fluid) grease type lubricant resists water and other unfavorable operating conditions to a marked degree. LUBRIPLATE No. 105 not only provides superior lubrication but offers utmost protection against rust and corrosion. Because of its waterproof feature and freedom from "drag", it is ideal for

General Industry Firearms
Radio Equipment Outboard Motors
Instruments Home Appliances
Business Machines Fishing Reels

LUBRIPLATE

Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE

Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE

Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

Write for a booklet, "The LUBRIPLATE Film", written especially for your industry.

LUBRIPLATE
PISKE BROTHERS REFINING CO.
NEWARK 2, N. J.
TOLEDO 2, OHIO



The splice applies the load stress in a direct line with the pull of the load. It has no seizings to loosen, unravel or get in the way; no wire ends to barb and tear workmen's hands. It is wide open for visual inspection at all times. It may be used with any standard fitting (hook, ring, shackle, thimble, etc.), and when the sling or assembly is retired such fittings may be salvaged and re-used. At the present time the new Acco-Loc Safety Splice can be applied only at the factory.

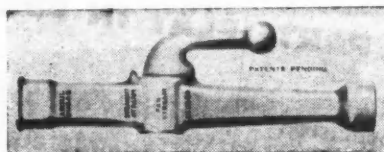
New Pickling Compound

A pickling agent to remove rust, scale, tarnish, and incrustations of cement and lime from metals in being marketed by Waverly Petroleum Products Co., Philadelphia, Pa. Troxide, as this new chemical is named, is a dry, inert compound. It is non-eruptive, non-inflammable, and is said to present none of the occupational hazards common to acids heretofore used in pickling.

Unlike the conventional acid pickling solutions, it is claimed that Troxide throws off no "acid-mist" or other toxic fumes which are pungent, corrosive, and harmful to workmen and machinery. Troxide may be used either hot or cold.

Dual-Stream Nozzle for Fire Extinguishers

Dugas Division of Ansul Chemical Co., Marinette, Wis., is introducing a dual-stream nozzle which is said to greatly increase the effectiveness of its wheeled model Dugas fire extinguish-



Dugas dual-stream nozzle

ers. The new nozzle permits the operator to apply the dry chemical on a fire either as a long range straight stream or as a shorter range fan stream.

With this dual-stream nozzle, overhead fires, heretofore considered exceedingly difficult to fight, can be extinguished successfully.

"Non-Scuff" Piston Rings

Engine performance and durability are said to be enhanced greatly with the application of the "Non-Scuff" compression piston ring recently developed by the Muskegon Piston Ring Co. Made of special alloy iron, it has raised corners on the upper and lower face edges which bear on the cylinder wall, and an inside bevel edge which produces torsional action. According to test work on several makes of engines, the rounded face edges permit the

(Turn to page 80, please)

LUBRIPLATE No. 107

IT'S WATERPROOF!



Industry, especially food packers, have long required a waterproof lubricant that was clean and easy to apply. LUBRIPLATE No. 107 is the answer. It is a general purpose lubricant, white in color and just the right density for application by pressure guns or grease cups. LUBRIPLATE No. 107, like other LUBRIPLATE products, arrests progressive wear, saves power, and protects machines against rust and corrosion. It will pay you to try LUBRIPLATE and see how it will cut down repairs.

R FOR YOUR MACHINERY

No. 3—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 8—Because of its high film strength and long life reflects outstanding performance in most types of enclosed gears (speed reducers).

No. 107—One of the most popular grease type products for general application by pressure gun or cups.

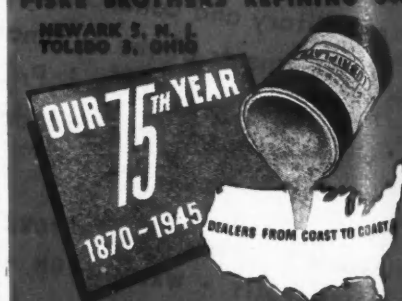
No. 70—For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA—Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 3000 RPM and temperatures up to 300 degrees F.

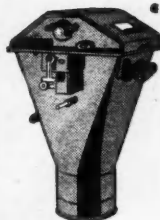
Write for a booklet, "The LUBRIPLATE Film", written especially for your industry.

LUBRIPLATE
PISKE BROTHERS REFINING CO.
NEWARK 2, N. J.
TOLEDO 2, OHIO



PRECISION AERIAL PHOTOGRAPHY MAPS THE ROAD TO VICTORY...

World War II has seen tremendous strides in aerial photography — potent weapon of modern war. Fairchild Camera and Instrument Corporation has played a leading role in the development and perfection of the precision aerial camera. The Fairchild model presented in this milling story is the K-18 — designed expressly for high-altitude intelligence photography, requiring large area coverage and large image size. Intended primarily for vertical photography, it is also used for low-altitude obliques. Equipped with lens of 24-inch focal length; 9 inches by 18 inches negative size; fully automatic or manual operation.



Fairchild
CAMERA



— Photo and data: courtesy Fairchild Camera & Instrument Corp.

Milling a film magazine seating surface for the Fairchild K-18 camera with special fly cutter on Milwaukee 3-H Vertical Milling Machine. Material: magnesium alloy; speed: 1500 rpm; feed: 7% inch per minute; cutter: 3-inch diameter with 2 tool bits; larger diameter tool bit: positive rake 20°, helix angle 15°, holder 3 inch, set-in 3½ inch; bottom tool bit: helix angle 0°, positive rake 25°, holder 3 inch, set-in 2 inch (cuts ½-inch lower than larger diameter tool bit); path, cutting distances: 20 inches wide x 15 inches across, cutting four sides; supporting wall ¾ inches thick; 10 minutes milling time.

PRECISION milling of thin walled magnesium and aluminum castings is difficult. Mirror finishes are usually a must, notwithstanding the amount of stock to be removed.

On this Vertical Milwaukee Milling Machine the rate of cross feed is exactly the same as the rate of table feed—resulting in a uniformity of surface and mirror finish over the entire milled area.

Milwaukee Milling Machines are especially adapted for this type of operation. Their three bearing spindle mountings assure smooth vibrationless operation at the sustained high speeds usually used in milling these metals.



TO MILL IT WITH SPEED...PRECISION...PROFIT
— PUT IT ON A

Milwaukee



**KEARNEY & TRECKER
CORPORATION**
MILWAUKEE 14, WISCONSIN

Here's the Inside Story of Speeding the Production of SUPERCHARGERS



To effect a smooth flow of production — and eliminate unnecessary handling — an A-F Conveyor System was installed in this airplane turbo-supercharger plant.

As superchargers move down the line, each operator adds a part or does a particular operation. At the end of the line, the superchargers are completely assembled, ready for final inspection. Production is kept in *perfect balance*.

In many plants from coast to coast A-F Engineered Conveyor Systems are now boosting production — lessening employee fatigue — increasing efficiency and cutting costs. The largest single production cost in industry is that of handling materials and products. Let us show you how an *endless-stream* Conveyor System engineered by Alvey-Ferguson can save time and costs. Write today for interesting folders.

THE ALVEY-FERGUSON COMPANY

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The Alvey-Ferguson Company of California

P. O. Box 396, Vernon Branch, Los Angeles 11, Cal.



CONVEYING EQUIPMENT

Alvey-Ferguson

METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

formation of a thin oil wedge between the ring and cylinder wall, resulting in elimination of cylinder and ring scuffing with reduction in wear of all rings in the set. This type of ring is recommended for top ring grooves in combination with the proper oil control rings. Owing to the flexibility of the ring, the lower edge bears heavily against the cylinder wall, holding thickness of the lubricating film to a minimum and sealing off blow-by.

Rotating Seal Requires No Auxiliary Springs

A new type rotating seal has been developed by the Cook Electric Company, Chicago, Ill., called the Spring-life "Gyro-Seal." No auxiliary springs are required in the application of "Gyro-Seals" because the inherent spring rate of Spring-life bellows is,



Spring-life "Gyro-Seal"

in most cases, sufficient to maintain the required pressure on the sealing surfaces. The bellows can be made of all types of metals to suit the conditions of each application. "Gyro-Seals" will operate on both external and internal pressure, and have been built to withstand 5,000 psi in a range of from slower than 1 rpm to faster than 4,000 rpm. Lapped finishes of the sealing members can be furnished to meet specifications wherein one light wave of flatness is required.

Optical Center Locator

Master Specialty Co., Minneapolis, Minn., is offering a new device which is said to speed up operations in constructing tools, dies, patterns, and molds. It is called the Optical Center- (Turn to page 82, please)



Center locator made by Master Specialty Co.

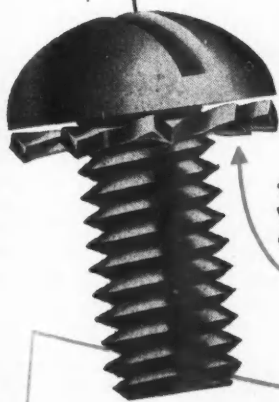
The "Sweepings"
Prove it!



**ELIMINATE WASTED LOCK WASHERS
AND SAVE VITAL ASSEMBLY TIME WITH**

SEMS *Fastener Units*

Reg. U.S. Pat. Off.



The Lock
Washer can't
drop off!

SEND FOR FREE TEST KIT!

Examine this pre-assembled fastener unit. See how the lock washer is held securely on the screw and yet is free to rotate. Note the superior locking power provided by the tapered-twisted teeth. Here's proof of economy and better product protection—write for your Test Kit No. 23 now!



Putting lock washers on screws is definitely "out-of-date". Not only are lock washers dropped and wasted, but think of the slow, costly, tedious task of putting them together. Your assembly line can achieve a faster tempo with SEMS Units because the lock washer and screw are handled as a single piece—they drive easier and there's no chance for the operator to "forget" the lock washer. Get the facts on comparative costs now—see how you can step up assembly efficiency and save money, too!

SHAKEPROOF inc.

fastening Headquarters

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
2501 North Keeler Avenue, Chicago 39, Illinois

Plants at Chicago and Elgin, Illinois

In Canada: Canada Illinois Tools, Ltd., Toronto, Ontario

Los Angeles Office

Detroit Office

5670 Wilshire Blvd., Los Angeles 36, Calif.

2895 E. Grand Blvd., Detroit 2, Mich.

Locator, and consists of a compound magnifier, a holding fixture and a set of drill bushings.

In use, the compound magnifier is clamped in the holding fixture and aligned over the layout lines on the work. When the reference circle, which is etched on the sight glass, is exactly centered over the layout lines the holding fixture is clamped to the work. The magnifier is then removed from the holding fixture and the correct size drill bushing substituted.

All-Green Wire Rope

Wire rope that is completely covered with a green-colored lubricant is now in production at the American Cable

Division and the Hazard Wire Rope Division of the American Chain & Cable Co., Bridgeport, Conn. Only their highest grade rope (preformed of improved plow steel) will be so lubricated. Their non-preformed ropes made of improved plow steel will continue to be identified by a single green strand.

American Chain and Cable's "Green-Lube" has high viscosity and remarkable capacity for adhesion to the surfaces of the wires. It has a grease-like consistency at normal temperatures and is applied hot and in a molten state by the pressure method which not only assures complete coverage of every wire but the filling of the voids between wires.

If it's a small part

...turn it with Precision, Speed and Profit on a

SHELDON



Model S-56
10" Precision Lathe

Engineered for precision shop and tool room work. Rigidly built to stand up and hold its close accuracy under round-the-clock operation. This is a quality machine tool in every detail, yet is moderate in price . . . a lathe that stands out far ahead of others. (The lathe selected by U. S. Army, the Navy and the Marine Corps for mechanized machine shops, instrument repair shops, etc.)

Contact us or your local Sheldon dealer for prices, engineering data, deliveries, etc.

All SHELDON lead screws are cut on the finest Pratt and Whitney "Super - precision" lead screw machine.

BUILDERS of
GOOD LATHES
since 1919.

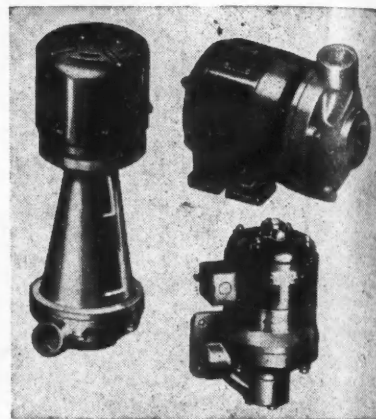
- Heavy bronze bearings
- 1" Collet capacity
- 11 1/4-inch swing
- Double-walled apron
- Large hardened and ground spindle
- Extreme accuracy
- Convenient controls
- Underneath V-belt motor drive
- All Steel Bench

SHELDON MACHINE CO., INC.

4220 N. KNOX AVE., CHICAGO 41, U. S. A.

New Line of Superflo Centrifugal Pumps

A new line of Superflo centrifugal pumps has recently been announced by the Gray-Mills Co., Evanston, Ill. Higher volume delivery per horsepower and ease of maintenance are features of these new pumps. The heavy-duty motors, mounted integrally to the pumps, are available in various sizes—1/25, 1/4, 1/2, and 1 hp. There are 13 basic models available with



Superflo pumps

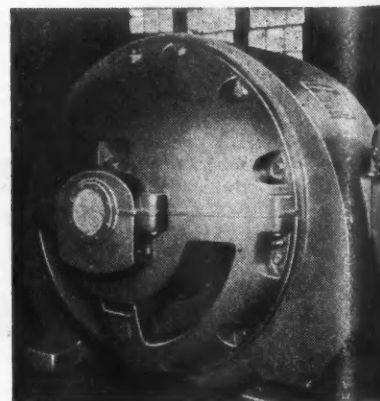
various voltage characteristics and volumes of 9 to 75 gph.

There are types for horizontal-external mounting; for vertical-external mounting; and other pumps with floating impellers are made for submerging in the coolant system reservoir. The latter may be used for fluids having abrasive content. Grease-sealed motor bearings and mechanical seals of the pumps require no lubrication.

G-E Adds Large Motor To Tri-Clad Line

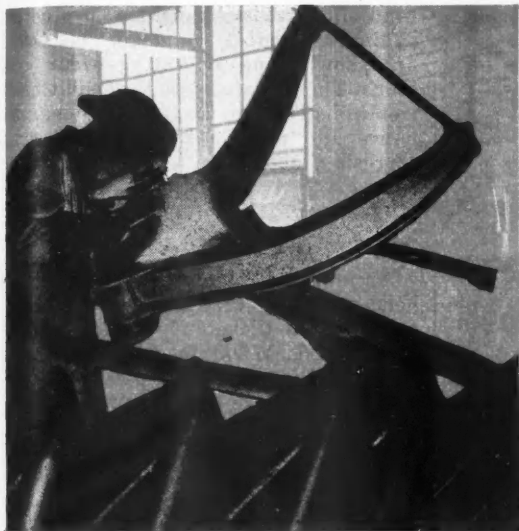
A 2000 hp Tri-Clad motor, the largest to be added to this line, has been announced by the General Electric Company. This squirrel-cage induction-type motor is specially designed for use in large central power stations and large industrial applications.

The new motor is in the 6360-frame series, which is five steps larger in diameter than the largest standardized (Turn to page 86, please)



G-E Tri-Clad 2000-hp motor

Production of Metal Parts

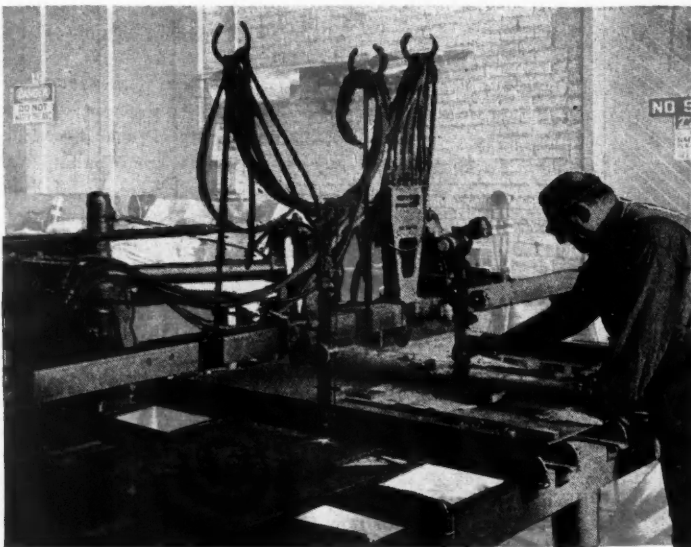
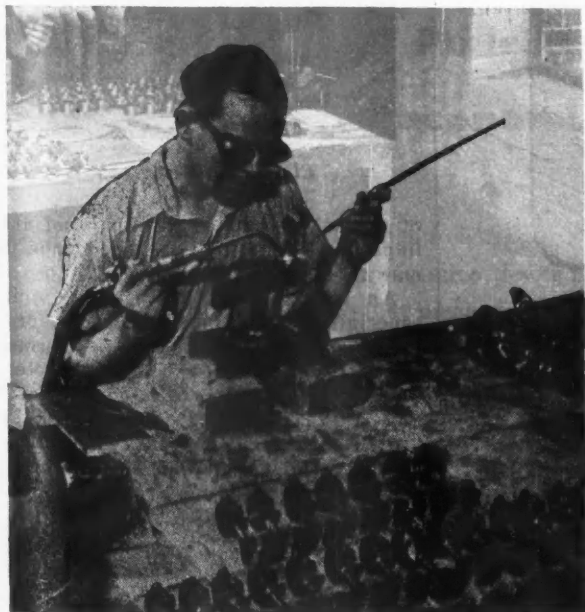


◆ **Arc Welding** has clearly proven its ability to reduce the weight of metal parts while providing maximum joint-strength. The aircraft beaching gear shown here are typical of the many parts now being fabricated by arc welding.



Flame Hardening increases the surface hardness of metal parts without affecting the toughness of the core metal. Special flame-hardening set-ups are easily devised for localized hardening of large or small parts at points of heaviest wear.

◆ **Machine Gas Cutting** speeds the shape-cutting of a wide range of steel parts of any commercial thickness. Thin gauge parts may be stack-cut in quantity with remarkable uniformity and accuracy. Airco makes gas cutting machines in sizes for every requirement.



Oxyacetylene welding is widely used for welding light-gauge metals of virtually every analysis. This method has a host of applications in aircraft and automotive manufacturing.



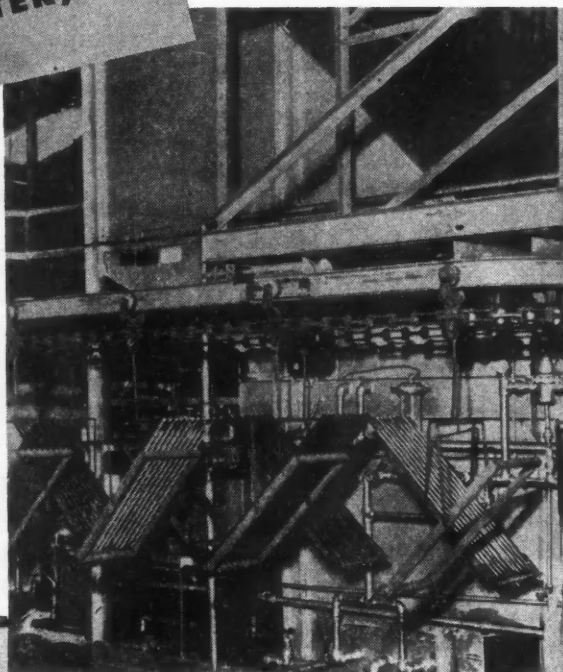
AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.
In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON 1, TEXAS
Offices in all Principal Cities



ELECTROMASTER, INC.
SAY:

**"CONVERSION
IS
NO PROBLEM
WITH DETREX
DEGREASERS"**



8 PRODUCTION CHANGES SINCE 1941

Early in 1941, Electromaster, Inc., purchased the degreaser shown above. Before they could use it in their regular peacetime production, it was put in operation for the degreasing of bomb fins. Since that time, new contracts for incendiary bombs, bomb burster tube assemblies (pictured), stampings for War Department materiel, and bomb adapters and parts have necessitated minor changes to accommodate the various products. The eighth change has been made only recently.

After the war, this company plans to utilize this same machine for the degreasing of parts for electric ranges and water heaters.

THE incendiary bombs dropped by General Doolittle on his first Tokyo raid . . . and thousands now finding their targets in Japan . . . are only a few of the war products which have flowed through this vapor-spray-vapor Detrex Degreaser. Degreasing operations, for weeks at a time, were on the basis of one bomb every three seconds in 24 hour day production.

For other types of products, too, this machine has proved equally as valuable to Electromaster. By changing fixtures and speed of cycle—accomplished in only a few hours it was found that any parts of a size which could be conveyed through the machine were degreased thoroughly and efficiently.

Any Detrex Degreaser is immediately adaptable to changing production needs—whether for war or peace.



DETREX
13001 HILLVIEW AVE.
MICHIGAN
Corporation

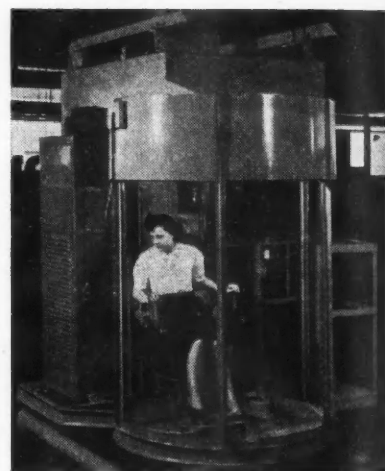
frame (namely, 505). Operating at 1800 rpm, it is rated 2000 hp, 2300 volts, 3-phase, 60 cycles.

The motor incorporates all of the basic protective features of the Tri-Clad line. These include protection against physical damage, electrical breakdown, and operating wear and tear. The end shields are of split cast-iron construction to facilitate maintenance and provide resistance to rust, corrosion, accidental blows, and rough use.

Air-Conditioned Crane Cab

An innovation in cab design for overhead traveling cranes has been developed by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, which includes full vision for the operator, comfortable sit-down control and air conditioning.

The transparent enclosure panels extend to the floor, permitting maximum vision in every direction over the area covered by the crane. The panels are



Cleveland crane cab

of a plastic which is shatter-proof and impervious to certain gases common in many plants.

An air-cooled air-conditioning unit, especially designed for this cab, provides fresh clean air at any normal temperature desired and gives protection against objectionable gases, dusts and fumes. The unit attached to the cab illustrated is for use where temperatures do not exceed 140 F. Sealing and insulation is provided to assure against excessive losses.

Anticipator Controls Furnace Temperatures

A vacuum-tube thermocouple device characterized by its anticipating nature has been brought out by Westinghouse Electric and Manufacturing Co. It is said to increase the sensitivity and response of conventional temperature controls by a thousand per cent. This instrument consists of two thermocouples of different thermal capacity and an electric heating element.
(Turn to page 122, please)

*It's what goes on **INSIDE** that counts*



ADD YOUR PUNCH IN THE LAST ROUND

**BACK THE 7th
WAR
LOAN**



Inside an engine, Pedrick rings yield many economies

HERE is a worthwhile crop of savings to consider. Fewer overhauls that mean less time in the shop, fewer repair bills . . . longer engine-block life that means more service per unit, fewer replacements . . . and lower fuel costs that mean important savings, accumulating day after day—these are the important benefits you reap when you install Pedrick *precisioneered* piston rings.

This fine performance of Pedrick rings is the outgrowth, largely, of Pedrick's exclusive process of Heat-Shaping. It imparts exactly the correct amount of

tension around the entire circumference and fixes it there for the full life of the ring.

If you are looking for piston or sealing-rings that meet the toughest requirements of precision and service, that are in the vanguard of metallurgical and design developments, investigate Pedrick *precisioneered* rings. Our engineers will be glad to confer with you on any ring problems you may have. WILKENING MANUFACTURING Co., Philadelphia 42, Pa. In Canada: Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

Pedrick
precisioneered **PISTON RINGS**

Surplus War Plants

(Continued from page 19)

in his industry. Generally speaking, the pricing formula will be about as follows: Current normal reproduction cost at straight time will be used as a base. This will be depreciated in accordance with the age of the building at normal rates. In addition, a further allowance will be made where extensive alterations are necessary to make the plant suitable for production of the buyer's peacetime product.

Admittedly, such a formula provides only a very broad working base and

serves merely as a guiding principle. However, each plant will be handled on an individual basis since scrambled facilities, such as are common in the automobile industry, present peculiar problems which cannot be reduced to formula but must be negotiated by finding a common area of agreement. No particular difficulty is expected in such cases, however.

While outright sale still stands as the most satisfactory disposal, there is a growing conviction in DPC that

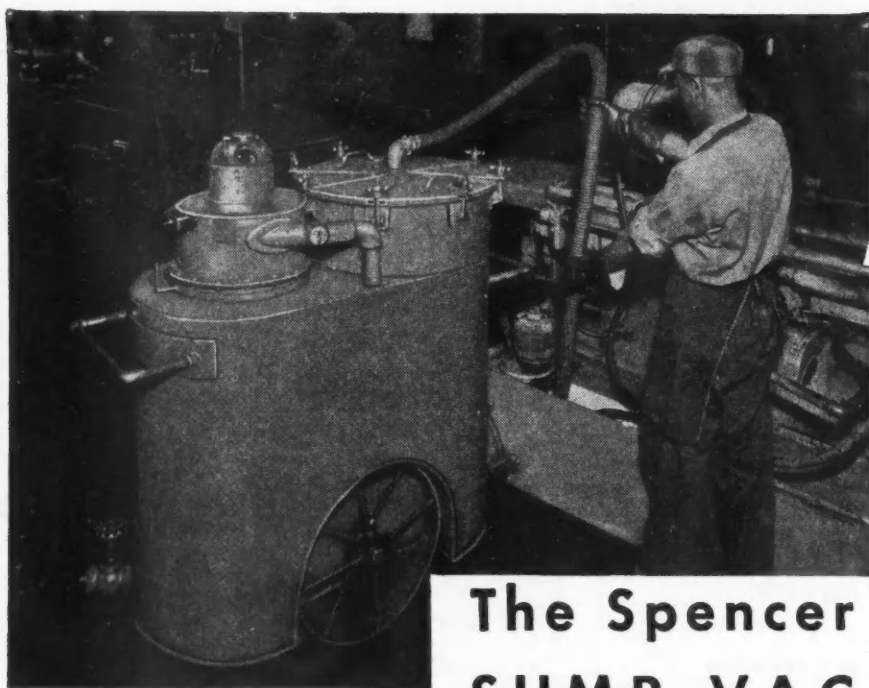
leasing agreements offer a desirable alternative. It is felt that a lease will offer continuity of employment and that within three to five years after the war the economic situation will have stabilized and crystallized enough so that both industry and Government will be in a much better position than in the immediate postwar period to arrive at an eminently fair decision on sale price. The lease would cover reasonable depreciation and return to the Government on its investment. The lessee would pay the taxes, insurance, and normal maintenance of the building, with the Government bearing the cost of structural changes.

There are several situations within the automobile industry that offer interesting speculation in regard to ultimate disposal of plants erected on company property. An example of this is the DPC magnesium foundry at the Ford Motor Co., in Dearborn. The plant has not been operating for many months and has been declared surplus since there is no longer a pressing need for magnesium and the process used was not economical. An interesting point is that the plant is located on property owned by Ford and is entirely landlocked by Ford holdings. DPC holds a lease on the land on which the foundry is located, together with easements for ingress and egress. The lease of land from Ford runs for several years after the unlimited emergency declared by the President is declared terminated. However, no other individual or company is likely to be interested in the plant, located as it is in the center of the Ford empire on company property, nor is Ford likely to welcome the idea of an alien enterprise in its midst. It follows, then, that Ford is about the only logical purchaser.

Officials of the company are unwilling to comment, for policy reasons, but it is understood that Ford could use the building for postwar automobile production if the price is reasonable. If the company does not buy the plant, then about the only alternative left to DPC would be to wreck it. Such a situation would appear to give Ford a whip hand in price negotiations, but actually DPC would remove the facility for salvage before it would sell at a price to give the company a competitive advantage. As a matter of fact, DPC officials say they have no fear that the large automotive companies will attempt to get windfall bargains on plants they can use, and that experience thus far has shown that they are willing to pay a fair price.

This same problem arises in connection with DPC financed physical construction in company-owned plants. In some cases, for instance, DPC has installed floors or floor coverings. Here again it will try to avoid windfalls, but will use an appeal to common sense and fair play to get a reasonable price for the property. If negotiations fail, the floors or other fixtures will be taken up and salvaged.

(Turn to page 90, please)



The Spencer SUMP-VAC

Cleans Sumps in 2 to 10 Minutes

A portable vacuum producer with a 125 gallon tank, on wheels, picks up liquid at the rate of 40 gallons per minute. Machine emptied by gravity in 2 minutes or elevates liquid by pressure up to 6 feet.

Filter basket collects chips, float valve prevents overfilling. No priming necessary. $\frac{3}{4}$ and $1\frac{1}{2}$ H.p. models. Ask for the bulletin.

SPENCER VACUUM
HARTFORD
CLEANING

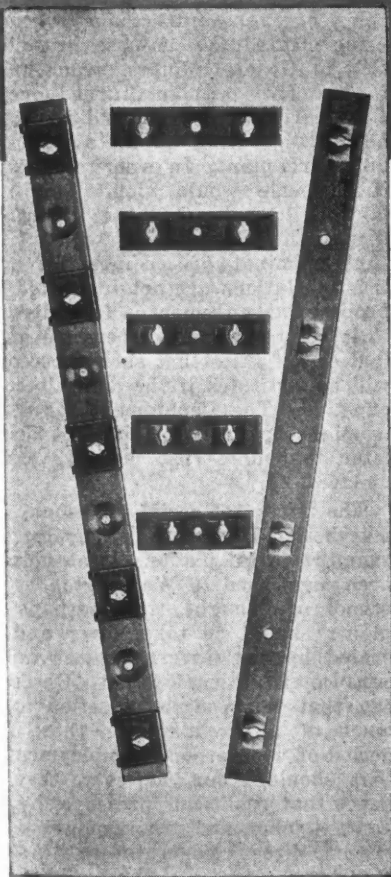
THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

ONE OF A SERIES PORTRAYING "THE SPEED NUT FAMILY OF FASTENERS"

TWIN AND
MULTIPLE
SPEED NUTS



YOU CAN'T BEAT
THIS *Combination!*



Twin and Multiple SPEED NUTS COMBINE Fasteners into One Unit!

● Individual SPEED NUTS offer tremendous advantages over ordinary fasteners, but Twin and Multiple SPEED NUTS go even further. They COMBINE two or more SPEED NUTS into one unit to simplify, reinforce and speed up multiple fastening attachments.

Twin type SPEED NUTS are available with $\frac{1}{2}$ " to 1" hole spacings, for machine or sheet metal screws. Center hole permits riveting in place for blind location assembly.

Multiple type SPEED NUTS are available, with 1" to 2" hole spacings, for 6Z, 8Z or 10Z sheet metal screws. Supplied in any desired lengths or in coils. Made of spring steel for riveting in

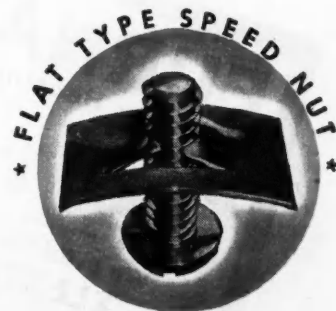
blind location, or stainless steel for welding.

Where "float" is necessary to compensate for unavoidable misalignment of holes, SPEED NUT Retainer Strips are recommended, as shown in panel at left. Here self-retaining "U" type SPEED NUTS are slipped over aluminum or stainless steel strips, in "float-ing" register with the screw holes.

In writing for samples, please give screw size and hole spacing.

TINNERMAN PRODUCTS, INC.
2039 FULTON ROAD, CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario.
In England: Simmonds Aerocessories, Ltd., London.



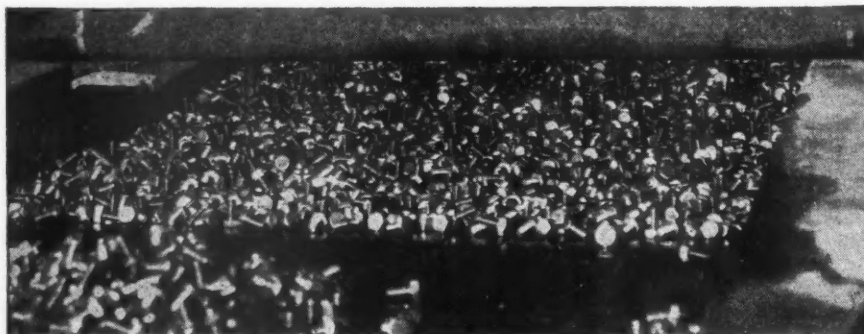
THE BASIC PRINCIPLE
of Spring-Tension Lock is
Embodied in all Speed Nut Designs

Speed Nuts
PATENTED * Trade Mark Reg. U. S. Pat. Off.
FASTEST THING IN FASTENINGS

May 15, 1945

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89



For Hardening Small Parts

175 to 2000 lbs. per hour

Products being treated in EF Chain Belt Furnaces, include:

Sprockets
Cap screws
Bolts and nuts
Gears and pinions
Flat springs
Coil springs
Small forgings
Valve springs
Spring plates
Tractor links
Rivets and washers
Wrench & tool parts
Bearing parts
—cups and cones
Machine gun
cartridge clips
Aircraft engine parts
Automotive parts
Rock bits, and many
other products

Uniformly—Scale-Free—Continuously

EF Chain Belt Conveyor Furnaces are dependable, general purpose heat treating units, for the continuous, uniform, economical, production heat-treatment of small and medium size products.

Hundreds are in operation, handling products ranging from small springs up to heavy crawler links for tractors. Some have been in practically continuous service 10 to 15 years. Maintenance cost is low.

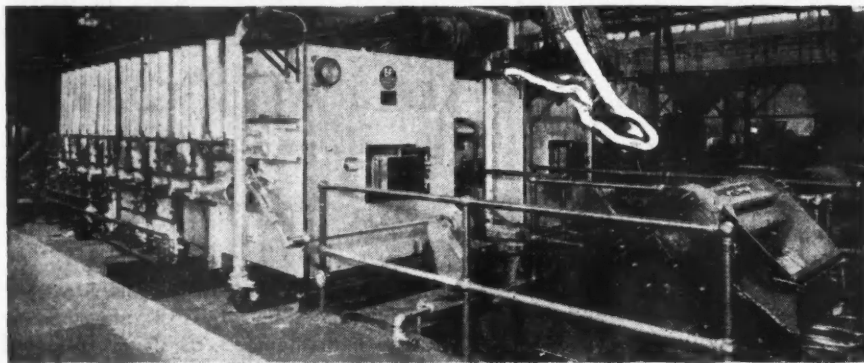
Built in seven sizes with capacities from 175 to 2000 lbs. per hour. May be oil-fired, gas-fired or electrically heated. Designed for using protective atmospheres for hardening without scale or decarburization.

Investigate their advantages.

Send for circulars showing the chain belt and other types of EF production furnaces.

The Electric Furnace Co., Salem, Ohio

(Below) An EF gas-fired radiant tube chain belt furnace . . . one of three in a midwest plant.



For Production Furnaces

For Handling Products in
Any Size or Shape

FURNACES

For Every Heating and Heat Treating Process

Oil, Gas or Electric

Nitriding
Normalizing
Soaking Pits
Scale-Free Hardening
Quenching Machines
Ceramic Kilns, etc.
Process Heating

Carburizing
Drawing
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Forging
Hardening
Malleablizing
Silver Soldering

Aluminum Brazing
Annealing
Billet Heating
Bright Annealing
Bright Hardening
Copper Brazing
Controlled Atmosphere

We Build the Furnace to Fit Your Job

THE ELECTRIC FURNACE CO.

SALEM, OHIO

For Production Furnaces

For Any Process or Production
Consult EF Engineers

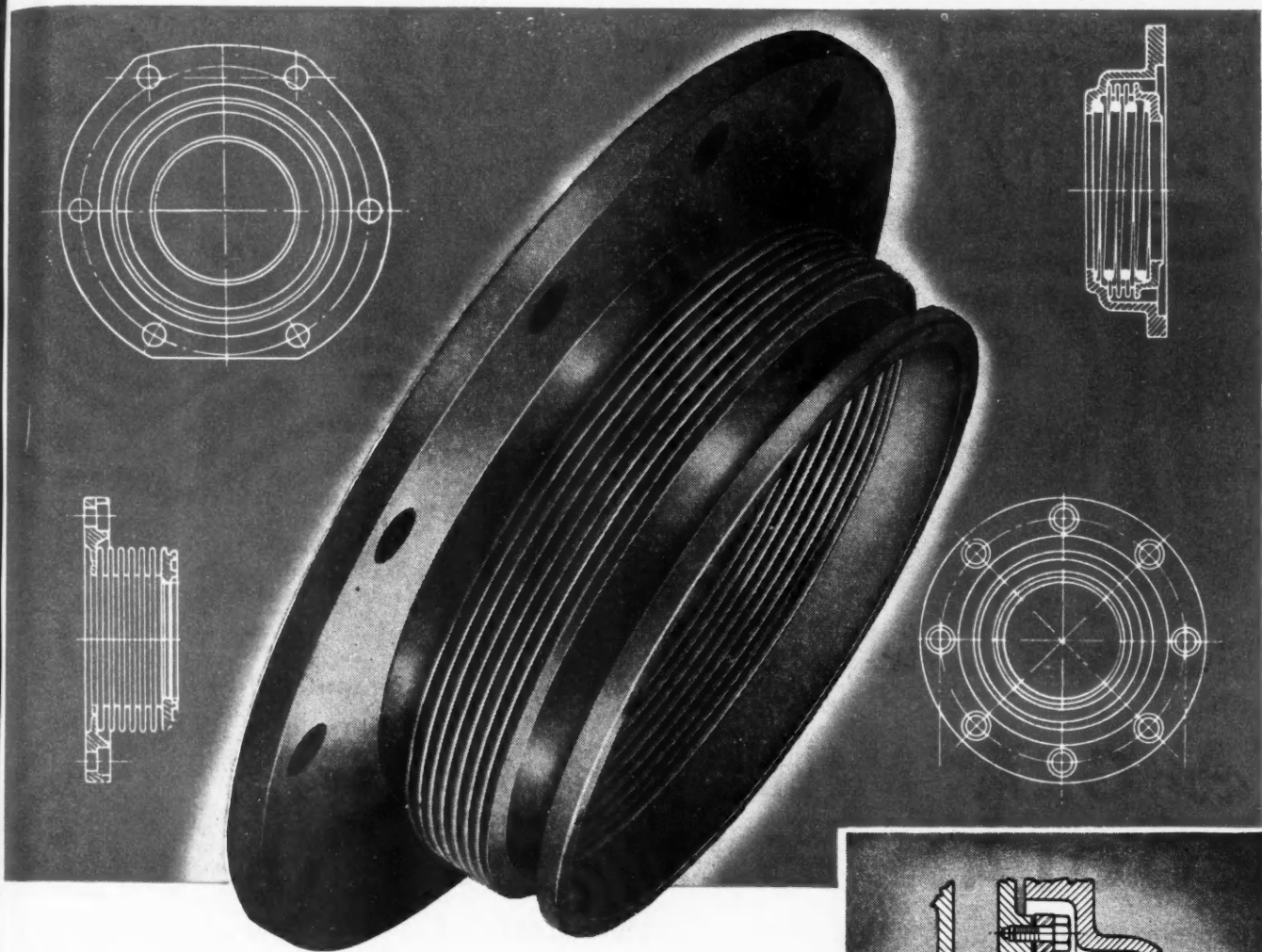
Another factor that must be considered in the disposal of surplus plants is whether the operator has any use for them in his normal peacetime operations. To an automobile manufacturer who does not intend to stay in the aircraft engine business, expensive test cells have no conceivable value. One automobile company says privately that it has no use for a large aircraft engine plant which it now is operating in another city because the construction is such that it would be cheaper and more satisfactory to build an entirely new plant than to attempt to alter the one it is operating. The place simply is too big and laid out too specifically for one purpose to make it a profitable venture. Another firm says it has no use for an aircraft engine plant it operates and will not even bid on it, even though it plans to spend considerable money on new construction in the postwar period. In view of this limited demand, coupled with the large number of DPC plants built during the war (approximately 1800) it appears that industry will not absorb all of them available even if the price is right. Some, of course, probably will be retained by the government as standby facilities and arsenals.

The fear of subsequent Government investigations and red tape may have some damping effect on surplus plant sales, but apparently that situation is being cleared up. A case in point is that of General Motors, which offered to buy back a plant turned over to DPC early in the war and which GM now is operating as an aviation engine parts plant. In order to determine if the sale would violate anti-trust laws, DPC submitted the proposal to the Justice Department, which stated that criminal proceedings for anti-trust violations are not instituted if a proposed arrangement is fully disclosed to it before becoming operative and if it does not state that such proceedings will be instituted if the action becomes effective. The Department added that it might bring civil suit if it decides later that anti-trust laws have been violated.

The impact of social philosophy also may be felt in disposal of surplus Government-owned plants. It already has been mentioned in Washington by one school of thought that perhaps the plants should be taken over and operated by the Government as an assurance of full employment. Observers say that this course of action is not much of a threat unless there is a period of widespread unemployment. If that should occur, however, they believe that political pressure by organized labor and others might result in some direct competition with private industry.

DPC is not waiting for customers to come to its door to buy properties. Rather it already has embarked on an active selling campaign to either sell or lease facilities that are currently declared surplus or will be eventually.

(Turn to page 92, please)

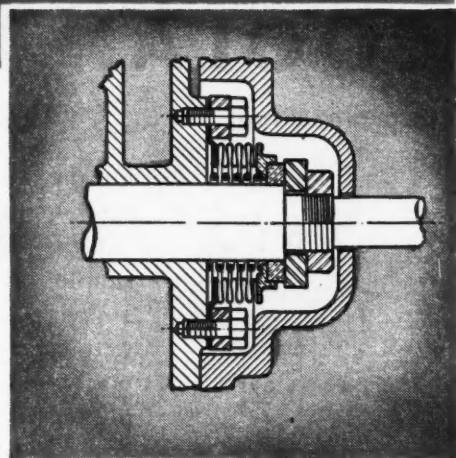


Now the **WHOLE** doughnut goes to work

WHEREVER there's danger of leakage of gas or liquid around a rotating shaft, there's need for a Sylphon Shaft Seal. Principles successfully applied to control problems for more than 40 years, have proved eye openers in this special field.

Basically, the application is very simple; a sturdy helical spring holds circular ring or *seal nose* firmly against a *sealing surface* mounted at the end of a shaft. A Sylphon Bellows provides a flexible, gas- and liquid-tight connection between a *mounting flange* and the *seal nose*.

Sylphon Shaft Seals are engineered for each specific application. Sizes range from seals for tiny instrument shafts to seals for huge military installations. Finely machined and balanced, they afford a perfect seal against pressures up to hundreds of pounds, operate at shaft speeds up to 400 RPM.



Sylphon Shaft Seal. Prevents leakage around a rotating shaft where the shaft extends from inside to the outside of enclosure.



New Movie—"The Story of Metal Bellows" is available to interested executives and organizations.

Write for Bulletin KP-825, giving as much specific information as possible about your problem.

FULTON SYLPHON

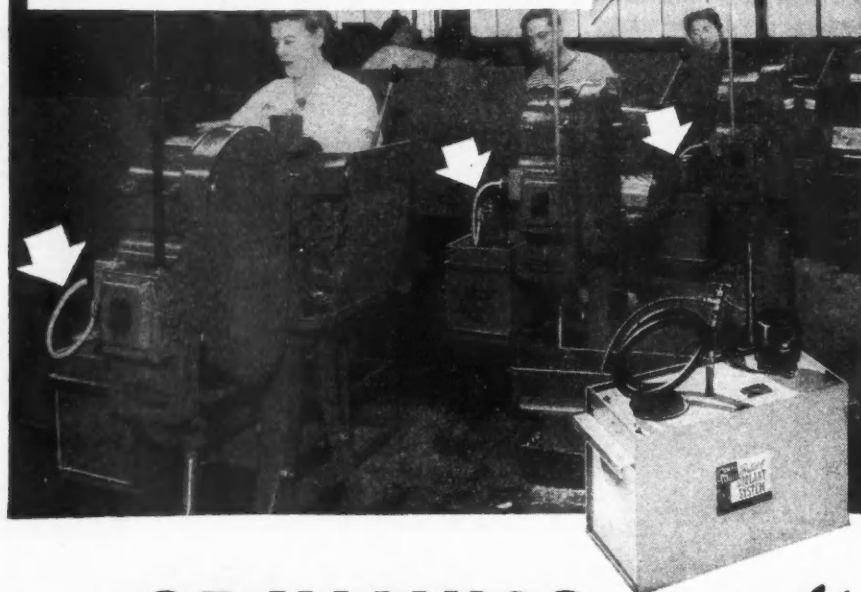
TEMPERATURE CONTROLS

BELLOWS . . . BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

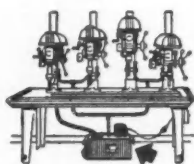
Canadian Representatives, Darling Brothers, Montreal

**Get the most out
of every machine**



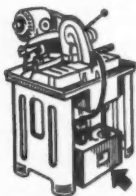
use GRAY-MILLS *portable* COOLANT SYSTEMS

to prolong tool life . . . improve finish . . . increase production



DRILL PRESS

Productive capacity of drill press increased by addition of this Gray-Mills Coolant System. Write for details... today



DELTA CUT-OFF SAW

Work is speeded up on this Delta cut-off saw by use of Gray-Mills system for supplying coolants.

On the lathes pictured above, and on other machines having no built-in coolant system—Gray-Mills Coolant Systems are the simple, effective and economical means of applying coolants or cutting oils. Used on grinders, drill presses, abrasive cut-off machines, lathes, metal cutting band saws, milling machines, etc., Gray-Mills Systems apply coolants in controlled volume, either constantly or intermittently. The increased production, longer tool life and improved finish that result will quickly pay for these easily installed, inexpensive Gray-Mills Coolant Systems.

Available in a variety of models, and with complete pans and fittings, for every requirement.

GRAY-MILLS CO.
1929 Ridge Avenue, Evanston, Illinois



Complete Portable COOLANT SYSTEMS

FRACTIONAL H. P. PUMPS • PARTS CLEANING SYSTEMS
INDUSTRIAL FLUID REFRIGERATING SYSTEMS

Hans A. Klagsbrunn, DPC vice-president, reported to the Senate Small Business Committee recently that his agency was negotiating for disposition of more than 200 plants, of which only 18 or 20 now are officially declared surplus. He revealed that DPC had approached 65 companies, both large and small, that appeared to have experience and technical ability to operate light metal or fabricating plants, and invited them to review DPC plants and to enter into negotiations if they were interested. It is apparent, however, that the number of plants sold to industry will be only a part of the large number now Government-owned. The remainder, which will have no market because of location, special construction, too high-cost, or other considerations, will either have to be turned over to Government arsenals, or operated by the Government, or dismantled and written off as one of the inescapable costs of war.

Smooth Flow of Thousands of Products

(Continued from page 38)

Thread mill $\frac{1}{8}$ -16 thread, thread mill $\frac{1}{4}$ -16 thread 2 in. full thread, thread mill $\frac{1}{4}$ -16 thread 2 $\frac{1}{2}$ full thread—Hanson & Whitney thread mill.

Wash, dip in rust proof oil and rack
Polish grind .746/.747 end with long $\frac{1}{4}$ -16 thread, polish grind opposite end .746/.747—Cincinnati Centerless grinder.

Wash in solvent, dip in rustproof oil and rack; process inspect.

Butler buff $\frac{1}{4}$ -16 threads—both ends, butler buff ground diameters—both ends, if necessary.

Hard bright chrome plate, bake.

Finish grind end having $\frac{1}{4}$ -16 thread, finish grind opposite end—Cincinnati Centerless grinder.

Wash, dip in rustproof oil and rack.
Butler buff chrome plating, chrome buff chrome plating.

Wash, dip in rustproof oil and rack.
Magnaflux, inspect and dip in rustproof oil.

To enable the reader to visualize the activity in this plant we have prepared a pictorial section consisting of views taken in various parts of this interesting plant.

BOOKS

CONVERSION FACTORS AND TABLES by Zimmerman and Lavine, Pub. Industrial Research Service, Dover, N. H. Here is a convenient pocket-sized handbook for the engineer and research worker, giving a comprehensive tabulation of conversion factors for all manner of physical constants and measurements. This is supplemented by a group of 14 conversion tables dealing with such relationships as—temperature conversions, vapor pressure, hydrometer scales, viscosity conversions, water pressure, etc. A key to definitions, prefixes and abbreviations also is provided.

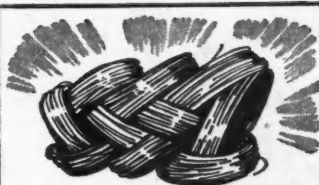
From Rivets to Armor Plate: Consult Reynolds

Today Reynolds Metals is sweeping forward as the nation's great new source of all forms of aluminum. Let Reynolds demonstrate what this all-out, tradition-free effort can do for you. Service offices located throughout the country.

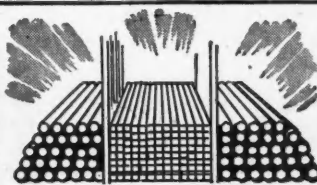
See the Reynolds catalog in Sweet's—or write for bulletins outlined in the paragraphs below.



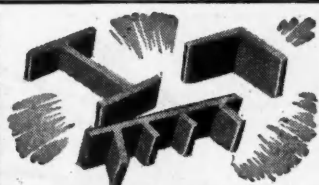
SHEET AND PLATE. Standard gauges, sizes, alloys. Special items. Bulletin 22-A gives specifications, ordering data, etc. 8 pp.



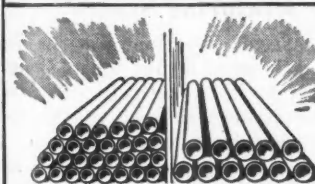
WIRE. Cross sections less than $\frac{3}{8}$ inches. See Bulletin 31-A for specifications, ordering data, etc. 12 pp.



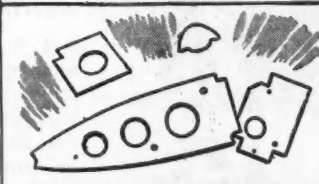
ROD AND BAR. Sizes from $\frac{3}{8}$ inches to 8 inches for forging and machining. Bulletin 31-A gives complete information.



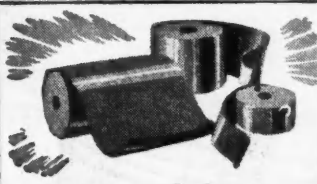
SHAPES. Rolled and extruded sections to fulfill individual needs. See Bulletin 35-A for full information. 8 pp.



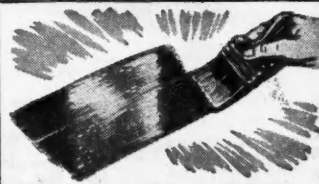
TUBING. Seamless. Closely controlled as to quality and dimensions. See Bulletin 17-A. Specifications, ordering data, etc. 8 pp.



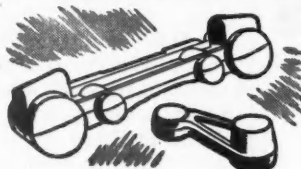
PARTS. Fabrication at aluminum source saves manpower, plant space, scrap and transportation. Ask for further information.



FOIL. For years the largest producer of light-gauge aluminum for packaging, technical and insulation purposes. Bulletin on request.



POWDERS AND PASTES. For aluminum coatings. Bulletin 21-A gives forms, applications, evaluations. 20 pp.



FORGINGS. Production capacity up to 2,000,000 units per month. Ask for details.



CASTINGS. Permanent mold and sand. Produced in one of industry's most modern plants. Ask for further information.

FREE! Many of the bulletins mentioned above belong in your files for quick reference. Please use coupon in requesting.



DON'T MISS THIS!

"Reynolds Aluminum, its Important Role in Tomorrow's Products," is of direct interest to every one concerned with design and production. 16 pages packed with useful information.

Reynolds Metals Company
Aluminum Division
 2513 South Third Street, Louisville 1, Kentucky
 Send post-free material I have listed:

NAME _____ TITLE _____
 FIRM _____
 STREET _____
 CITY _____ ZONE _____ STATE _____

Cooperative Wind Tunnel

(Continued from page 23)

piston unit, having a 0.10-inch clearance and less than 0.002-inch stroke. Forces exerted on the capsules are balanced by hydraulic pressures developed within the capsules. The resulting pressure changes within the capsules are transmitted to the indicating system.

In the case of the Lift capsules, the entire weight of the suspension system (50,000 lb) is supported on the new-type Emery capsules, yet a one-pound weight added to the system pro-

duces a readable signal at the indicator in the control room.

Indicating System

Hydraulic connections from the weighing sides of the capsules transmit pressures to the pressure sensitive elements in the Tate-Emery indicator cabinet, located in the control room. Combinations of pressure-sensitive elements in each indicator permit weighing pressures to be added to give the sum or subtracted to give the differ-

ence of the pressure resulting from the forces being exerted in the tunnel suspension system.

The calculations involved in reduction of measured loads to dimensionless form and the application of corrections necessitated by the test conditions are carried out using punched card methods and International Business Machine tabulation equipment.

Motor-driven following devices sense the positions of the Tate-Emery indicators at the rate of approximately three times per second and translate this information into numerical values corresponding to the quantities being measured. At each sensing, these values are visible in a flash of lighted numbers on the control console. By the depression of a control button the operator can cause the numbers appearing at that time to be automatically printed on data forms and simultaneously punched into electric accounting machine cards for subsequent processing in IBM tabulating machines.

A means is also provided whereby any further numerical information which may be desirable to record may be set up in keyboards similar to adding machine keyboards and automatically recorded at the same time as the indicator data. This information will also appear in the light banks on the control board.

Metrical Measuring System

The metrical, or load-and-moment measuring, system is unique in several ways. First, it is entirely contained within the structural shell of the tunnel and, therefore, must operate at pressures both above and below normal atmospheric pressure; secondly, forces or moments arising from the air loads on the model are transmitted to the force-and-moment measuring devices through bearings of the oil support type, and thus there are no bearing frictions entering the final data readings; and, third, all forces and moments are separated so that the six components — lift, drag, cross-wind force, pitching moment, rolling moment and yawing moment are made available in the form of direct reading data, without the necessity of additional computations.

The lowest member of the metrical system is a triangular frame (the main frame) which rests on three supports carried in the bottom of the spherical shell surrounding the tunnel working section. Between the main frame and these supports are three load-measuring capsules. These capsules serve to measure any change in vertical load in the system and, since the model suspension system is attached to the metrical system during operation, and, since vertical loads on the model correspond to lift forces, these capsules directly measure the lift forces on the model in the tunnel.

The top of the moment table is the line of separation between the metrical (Turn to page 98, please)



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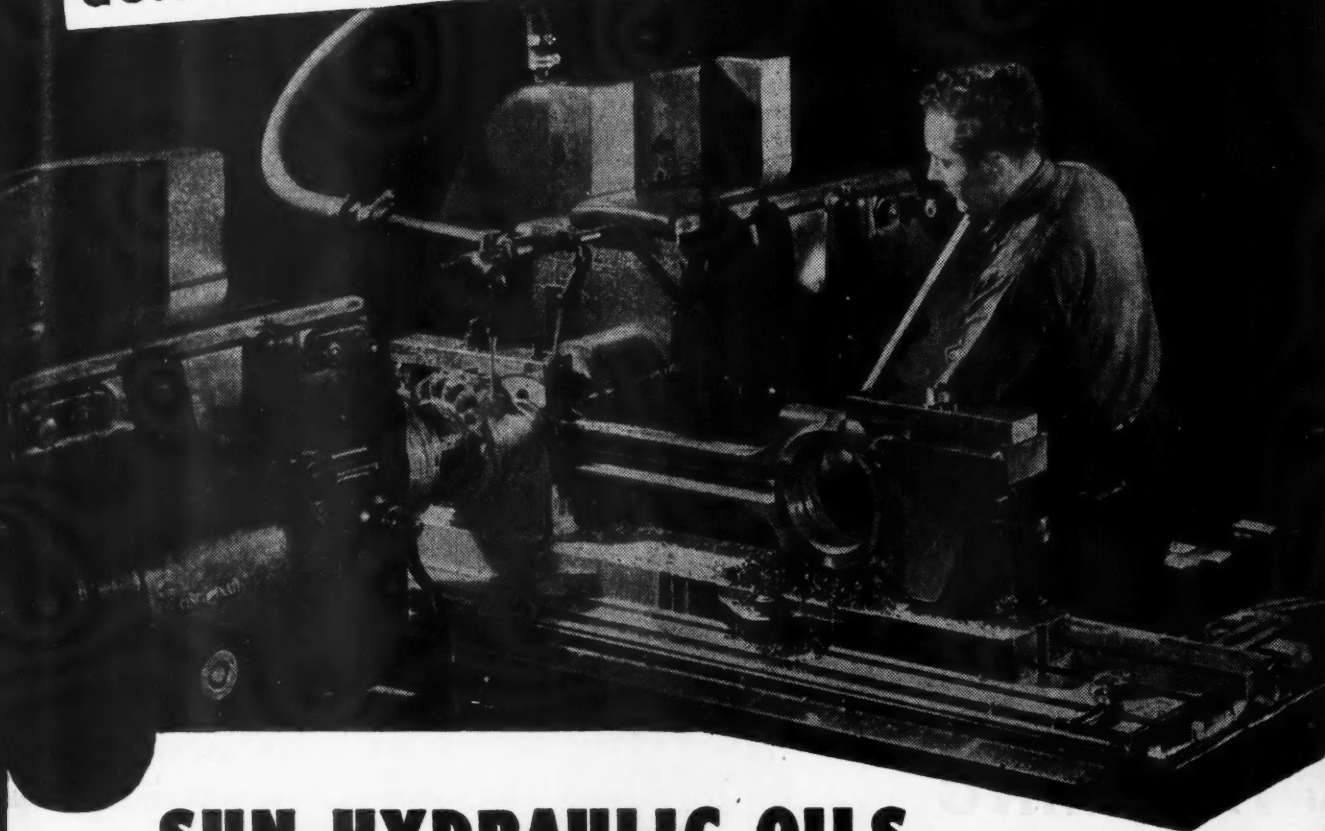
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Often, small changes permit a plant to increase its efficiency, to save money, and to eliminate costly "time-out" periods. This is especially true in specifying petroleum products, for each lubricant or oil must meet the particular requirements of a particular operation. For example:

A manufacturer was machining forgings on a big milling-machine, and ran into trouble with the oil in the hydraulic system that operated the machine.

Valves stuck, and gum had to be cleaned out at regular intervals. Production was being slowed down, and men were wasting valuable hours in cleaning-up machinery.

Gum vanished, and valve-sticking stopped after a Sun Oil Engineer was called in and

recommended Sun's Solnus Oil. The oil met the requirements of the job and had to be "added-to" only once in five months. Maintenance-men were no longer tied to this machine. Savings were estimated at about \$360 a year.

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system and the model suspension system. For the three point and the NACA support system, there is attached at this point a cross beam which carries the main support arm and a device to support and move the tail strut.

Model Power Supply and Dynamometers

In order more adequately to simulate true flight test conditions, certain models will be equipped with high-speed electric motors driving scale-size propellers running at top speeds, equivalent to those in actual flight. For this purpose the laboratory is

equipped with a system of high-frequency power supply, regulation and control, together with electric torsion dynamometers and wide-range power-metering equipment for model motor calibration.

Model power supply is provided by means of two adjustable-frequency, adjustable-voltage, alternating-current generators, each driven by a variable speed direct-current motor. The generators are rated at 200 kva and may be operated in parallel to supply model power loads up to 400 hp, over a range of 150 to 450 cycles. Voltages are available up to 600 volts. The dual generator supply has been installed to

enable operation of multi-motored models, such that one or more motors may be run at a speed different from all other motors on the model. The two frequency sources are also intended to permit testing contra-turning propeller models with right- and left-hand propellers at the same or differing speeds.

Main-Drive Power Plant And Controls

The tunnel fan system is driven by a two-element, electric motor-set with a peak rating of 12,000 hp. The basic drive unit of this set is a variable-speed, direct-current motor, supplied through a separate motor generator which is made up of a variable-voltage, direct-current generator directly coupled to, and driven by, an alternating-current motor of the synchronous type. These three machines, comprising the direct-current system, have a top rating of approximately 2000 hp at 570 rpm. Power requirements beyond the capacity of the direct-current system are supplied by an alternating current, variable-speed, induction motor having a wound rotor and slip rings and a short-time capacity of 10,000 hp.

One of the functions of the direct-current component in this system is to enable a quick slow down of the air in motion in the tunnel by the means of absorbing power back into the electrical system through provisions for regenerative-braking feed-back. Another important requirement for precision testing is met by the adaptability of direct-current machines to a modern electronic speed regulator with which this drive is equipped.

Electricity is purchased wholesale from the Pasadena Municipal Light Plant. Service is brought to the laboratory underground through a 17,000-volt cable. At the wind tunnel substation the voltage is stepped down to 2300 volts for use in the main machinery and in a separate transformer bank in the same station is reduced to 440 volts for auxiliaries and for supplying local transformers for small power and light circuits.

Cooling and Dehydrating System

The cooling specifications call for continuous operation of the equipment at a power input of 12,000 hp with the temperature of the air inside the tunnel limited to about 125 F. The radiator, which removes the corresponding amount of heat about 500,000 btu/min, is located in the fourth wind tunnel, just upstream of the contraction. It consists of 80 units of finned copper coils, each coil having three rows of tubes in depth.

Recently it has become known that the relative humidity of the air is one of the important parameters of high-speed flow. Furthermore, any appreciable accumulation of moisture would cause considerable inconvenience and complications. Therefore, it became advisable to control the humidity of the air inside the tunnel. This is

(Turn to page 100, please)

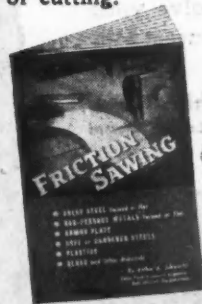
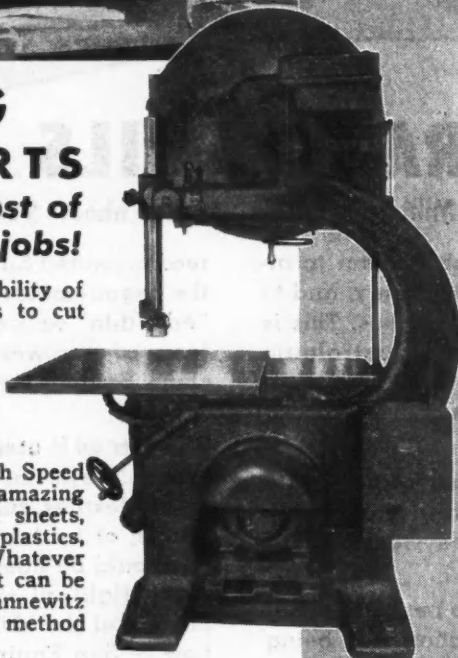
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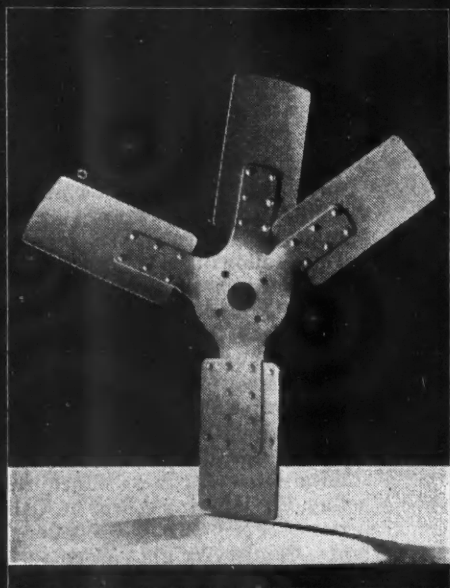
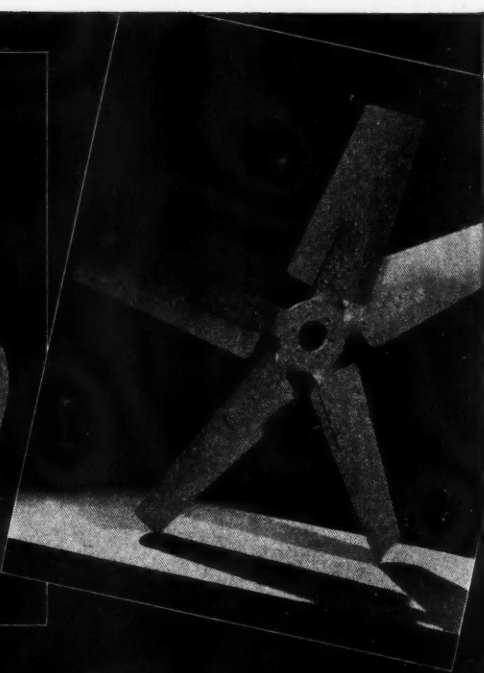
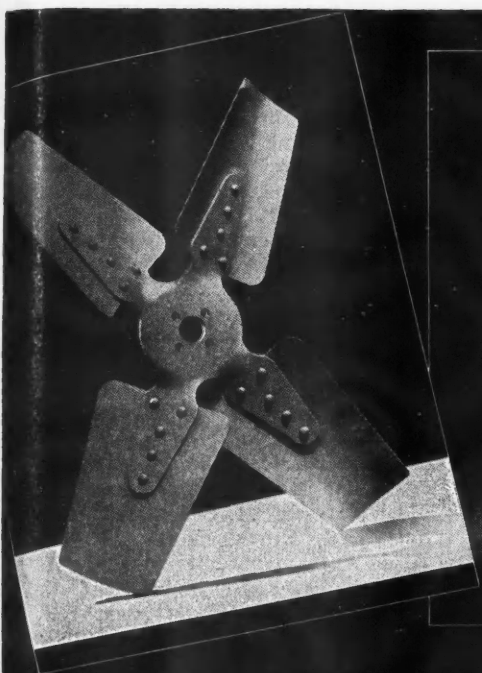
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done by means of the so-called dehydrator, an air-to-brine, heat-exchanging coil which reduces the temperature of the air passing over it to about 40 F. The brine in turn is cooled by ammonia, which is piped to the tunnel from the neighboring refrigerating plant of the California Consumers Co. During periods and shutdowns, the tunnel air can be circulated through the dehydrator by means of a 3000-cfm circulating fan, and all fresh air entering the tunnel through the air compressors also passes over the dehydrator before entering the tunnel.

The following scientists and engineers were primarily responsible for the design of the wind tunnel and of its many complex components: Drs. A. L. Klein, E. E. Sechler and N. B. Moore, Messrs. M. Serrurier, P. V. H. Serrell, J. E. Smith, L. G. Fenner, M. de Ferranti, W. Hertenstein, H. F. Richards, A. Fejer, F. M. Graf, J. W. Hill, J. B. Taylor, H. O. Cox and K. P. Gow. In addition, members of the California Institute, headed by Dr. C. B. Millikan, and cooperating companies' staffs too numerous to mention, made essential contributions to the design and successful construction of the laboratory.

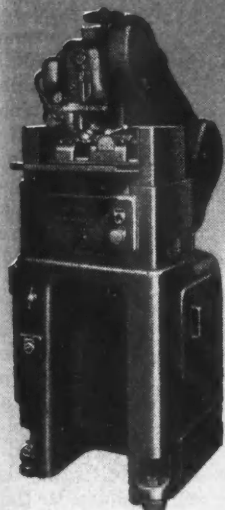
The problems involved in the construction of many elements of the wind tunnel were of extreme difficulty and required the highest degree of ingenuity, accuracy and workmanship. The following organizations, which furnished the major components of the project, made the completion of the laboratory possible by their successful solution of these problems: Consolidated Steel Corporation, Ltd.; Baldwin Locomotive Works; Tate-Emery Co.; Westinghouse Electric and Manufacturing Co.; General Electric Co.; International Business Machines Corp.; Gay Engineering Corp. of Calif.; Carrier Corp.; Curtis Propeller Division of Curtiss-Wright Corp.; Wm. C. Crowell Co.; and the Fluor Corp., Ltd.

Ford to Open Parts Depot in Seattle

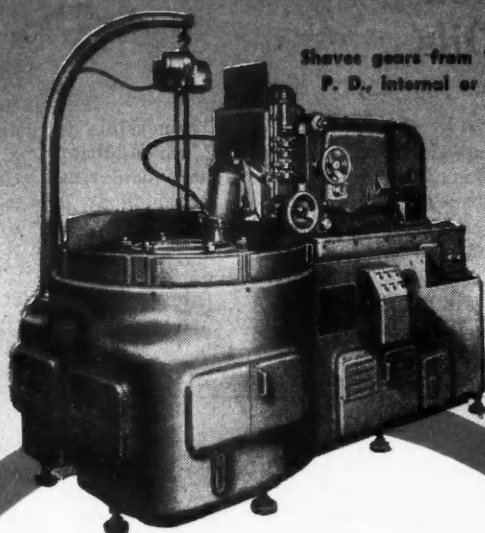
Ford Motor Co. has purchased a 12-acre site and announced plans for an \$800,000 parts depot at Seattle, Wash., to serve Ford dealers in the state of Washington, Northwest Idaho, and most of Oregon. The depot is one of several to be built as part of the company's \$150 million postwar expansion program.

Advertising Note

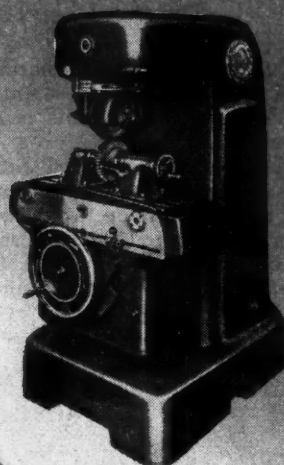
Major Bert R. Greene has been appointed to the account executive staff of the Ralph H. Jones Co. In addition to servicing the agency's accounts, Major Greene will represent the Ralph H. Jones Co. as a sales and distribution counselor, assisting clients with their merchandising problems.



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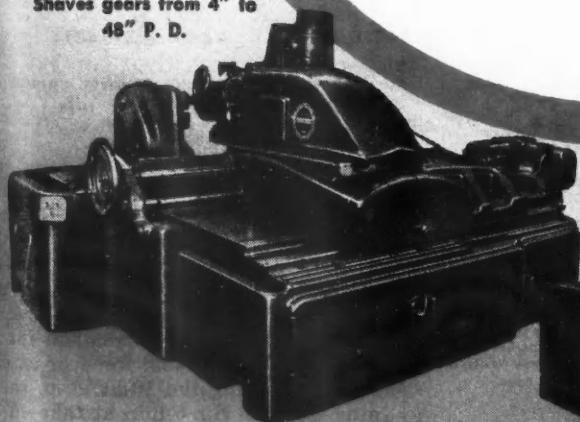
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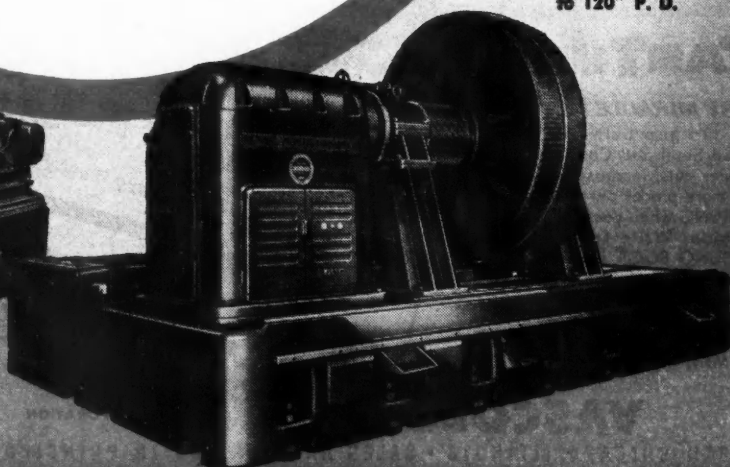
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Thermal Stability Method Of Evaluating Engine Oils

(Continued from page 32)

at 100 C. The effect on thermal stability of the addition of these antioxidants to the two respective oils is shown in Tables I, II and III.

All the tests mentioned (and others with different oils) show convincingly that, depending upon the nature of the oil as well as the test temperature and the concentration of the antioxidant, the effect of one and the same antioxidant may be positive, neutral or nega-

tive. Consequently, it is impossible to speak of the quality of an addition agent, in general, without considering the nature of the oil to which it is added or the thermal conditions in the engine in which the oil is to be used.

Dealing with the effect of selective refining on the thermal stability of aircraft engine lubricating oils, it was frequently observed that the thermal stability numbers of selective oils were

lower than those of oils purified by the acid contact process. Results obtained showed that the thermal stability of the oil is decisively improved by refining with 50 per cent nitrobenzene, practically as much as by the addition of antioxidants. But further refining with a larger proportion of nitrobenzene caused a reduction in thermal stability. After refining with 350 per cent nitrobenzene, the thermal stability is the same as that of the original sample. It would seem, therefore, that small amounts of nitrobenzene liberate the natural stabilizers present in the oil and allow them to act, while larger amounts remove them from the oil.

Tests were made with castor oil, and its derivatives, as additives to mineral oils, the derivatives being floridin, lactid and aerol, all of which are soluble in mineral oils. They were found to affect the thermal stability of the mineral oils only when added to the latter in amounts above 1 per cent.

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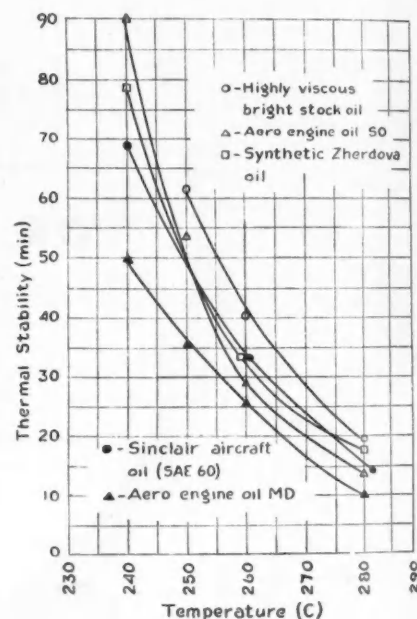


Fig. 5—Thermal stability curves of various engine oils.

Grading of various oils by their thermal stability was compared with the behavior of the same oils in a standard aircraft engine, the M-11, a five-cylinder 100 hp radial. Duration tests of 50 and 100 hr were made in steps of 5 or 10 hr each. During the 5-hr test period, the engine was run for 1 hr at take-off output and for 4 hr at climb output. During the 10-hr step, the engine was run for 5 min at take-off output, 1 hr at rated output and 8 hr, 55 min at cruising rated output.

Comparison of the thermal stability bench tests of the oils with the physical condition of the piston rings after the flight tests (Table IV) shows a definite relationship between the thermal stability number and the actual sticking of the piston rings. All the oils which caused rings to stick had a thermal stability at 280 C of between

(Turn to page 104, please)



103



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A combined rust-preventive and lubricant. Meets U. S. Army and Navy specifications. Ideal for aeronautical and similar precision instruments. Widely used wherever small parts are subjected to sharp temperature changes or temperature extremes.



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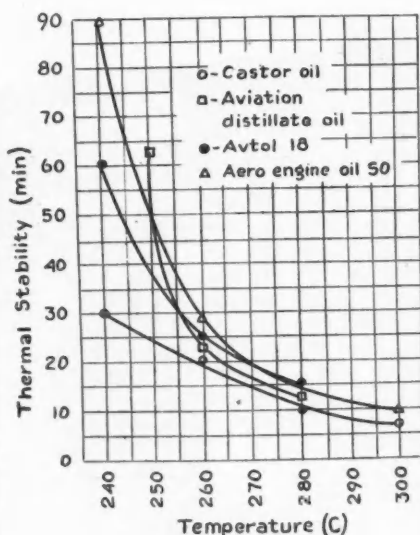


Fig. 6—Thermal stability of castor oil compared with that of mineral oils of equal viscosity.

5 and 9 min. The thermal stability of the oils giving a normal state of the rings ranged from 12 to 14 min, which may be considered to be a large increase in time.

The results of these tests are sufficient evidence that the thermal stability number correctly reflects the properties of the oils responsible for the sticking of piston rings and for the formation of lacquer-like films on various parts of the engine, according to the conclusions of K. K. Papok in his comprehensive paper on the subject translated by the British Ministry of Aircraft Production.

ASA Starts Project on Drafting Room Practice

At the request of the War Production Board the American Standards Association has approved a new war project for developing a group of American War Standards to coordinate the drawing and drafting room practice of the Army, Navy, and industry. This work also has peacetime significance, because of the multitude of blueprints, plans, and drawings used in the design and manufacture of even the simplest mechanical device.

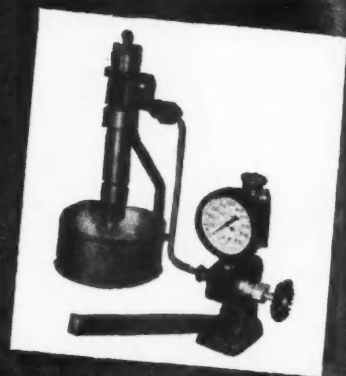
ASA has long had a regular committee on drawing and drafting room practice working under the joint technical leadership of the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education. Standards developed by this committee have laid down the simple basic elements of the subject. This new work requested by the WPB proposes to carry the subject further into the realm of modern industrial production.

The work will be financed by the War Production Board through an already existing Government contract under which the ASA has, since July 1942, completed 88 standards of vital and di-

(Turn to page 110, please)

ADECO NOZZLE TESTER

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TESTS FUEL INJECTORS AND HYDRAULIC DEVICES
At Pressures Up To 10,000 p.s.i.

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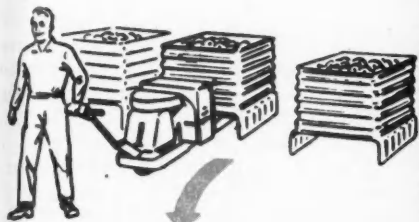
Light in weight yet built for heavy-duty service, it enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Tests both large and small injectors, on bench or engine, at pressures up to 10,000 p.s.i. Prevents costly delays and possible damage to engine.

Ideal for testing hydraulic devices.

Write for bulletin on this practical, low-cost unit.

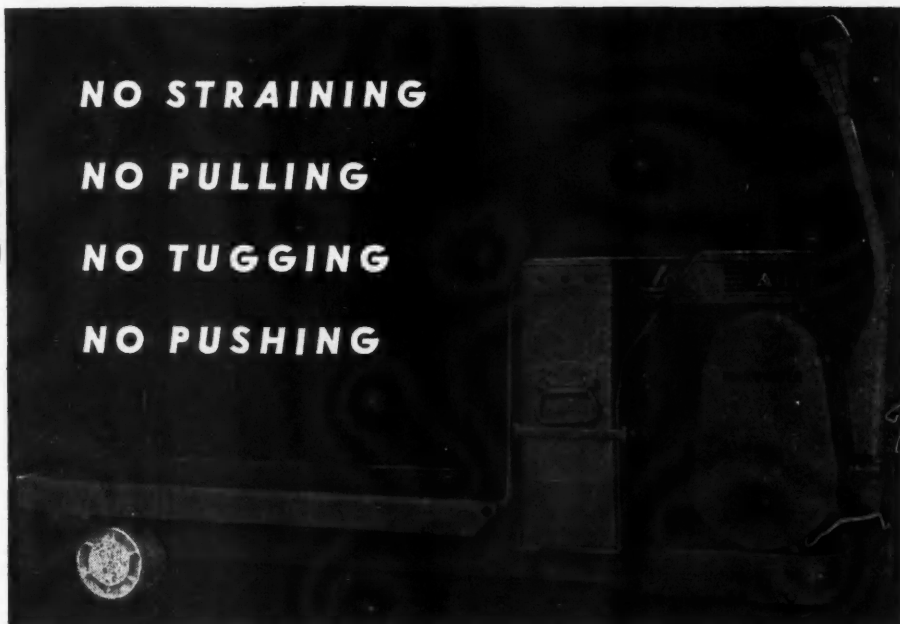


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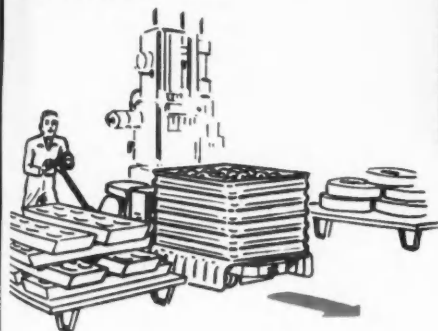


STEP I—Skid loads from production are quickly dispatched using one man or woman with "TRANSPORTER."

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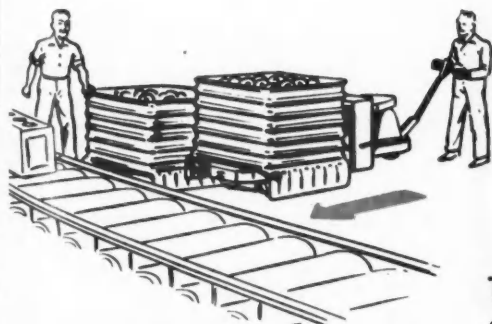
STEP II—Assembly machines 10 to 25 feet apart are easily served by using "TRANSPORTER." Narrow aisles can be readily maneuvered.

★ **Results:** Reports show 100 to 500 tons of material per day can be easily handled and dispatched by using one man or woman with "TRANSPORTER."

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This lift truck is designed to serve all industry for economical and safe lifting—spotting, and short hauling of various loads of raw materials and finished products on skid platforms up to 6000 lbs. and on pallets up to 4000 lbs.

Write for Bulletin No. 8



STEP III—Finished products are quickly moved from assembly to final packing marking and strapping line with "TRANSPORTER" operations.

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Division of the Yale & Towne Manufacturing Company

Packaging as a Part of Planned Production

by Ezra W. Clark
Vice President, Clark Tractor

INTELLIGENT analysis of the functional requirements of industrial packages is bringing about a swift and far reaching revolution in package design in many industries. Time was when manufacturers generally packaged their products in whatever manner best suited their own handling and shipping

needs; and the carrier, warehouseman and customer of necessity adapted their own handling methods and equipment to that pattern. Today that process is largely reversed.

It is more and more clearly recognized that the production of goods is an inclusive process embracing every

activity from the source of raw material to delivery of the finished product. And packaging methods and designs are being re-examined and revised as an integrated phase of Planned Production.

Two conspicuous examples of this trend are the development of the water proofed fibreboard containers, under pressure of military supply needs, and the wide-spread adoption of palletized unit packages for many industrial products.

For overseas shipments, the necessity for water proof fibreboard containers cannot be over-emphasized. A survey of packaging, shipping and materials handling, which the writer made for the Government in the European War theatre, quickly divulged how little the majority of American manufacturers knew about the conditions of transportation and handling to which their packages would be subjected.

These manufacturers assumed that overseas conditions would be the same as domestic. They failed to take account of the fact that many "goods wagons" of Europe's railways—small cars about 20 feet in length with leaky tarpaulin covers—were a far cry from sturdy, weather-tight American box cars; with the result that fibreboard containers were quickly reduced to a mushy state, and damaged goods, extravagant delays and extra labor were the rule rather than the exception. The speed with which this critical problem was solved is definitely to the credit of American manufacturers.

The development of palletized unit packaging, which came simultaneously with the design of special fork truck handling equipment, was carried out with the cooperation of a leading automotive manufacturer. Under this revolutionary new method, automotive parts of many kinds are placed on pallets, loaded into freight cars, unloaded and stacked in warehouses, and remain in their original unbroken packages until the pallets are moved to the assembly line. Wholly eliminated are several traditional steps—opening packages for checking, and all the rehandling operations. It was quickly demonstrated that errors in count are negligible—that care at the packaging point is the most effective preventive; and that claims—even after a lapse of six months or more are easy to adjust.

In contrast with these minor factors, the advantages and economies gained are enormous. Chiefly, the cost burden imposed on production by unskilled labor used to move and handle materials, is done away with. This emancipation of unskilled labor is essential to American industry's successful future—emancipation for the acquiring of skills, for higher pay and a better standard of living, for the vital, creative producing jobs; in order that America can meet the competition of world-wide unskilled labor by producing finer quality in enormous quantities at matchless low cost.

ON THE BEACHHEADS



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POWER INTO ACTION!**

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THAT VITAL SPOT
where
POWER TAKES HOLD
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Parking Lights Present a Problem

By Charles Ham, Jr.

Engineer, Electronics Dept., Sperry Gyroscope Corp.

THE advent of the sealed-beam type of headlight represented a real step forward in automotive design. However, a problem emanating partly from its adoption appears to have been neglected. It results directly from the practice of operators in many large cities of using parking lights (not depressed headlights) almost exclusively for evening and night driving. This practice may to some extent be justified in view of the general high level of street illumination, but it nevertheless creates certain hazards which could easily be eliminated. The contention that a solution could be found in legislation requiring the use of depressed headlights cannot be seriously entertained, nor is that solution considered practicable or desirable. It is a problem for the automobile lighting engineer.

Because they are usually of small area, parking lights, when used for night driving in cities, set up conditions which are fraught with danger. This small, and not too often bright, source of light is very difficult to distinguish from street lights and other random lights when the vehicle is approaching in a direction from which such lights form a background for the vehicle, particularly where small hills and curves cause the vehicle lights to blend with stationary lights thus producing a combination wherein it is not easy to identify the moving vehicle. An especially bad condition exists wherever there is an over-abundance of one-parking-light vehicles. In such cases the possibilities of distinguishing between car and street lights becomes even more difficult.

Another and equally serious condition exists when approaching vehicles have different types of lights in operation as, for example when one or more cars with depressed SB headlights are followed by a car with parking lights in operation. To persons afoot or in vehicles proceeding on the same street in the opposite direction or approaching that street at right angles, the car with parking lights in use may not be seen and the chance of collision with it thereby increased. Increased size and uniform location of parking lights would materially decrease that danger.

There is a serious lack of uniformity in the location of parking lights and when they are used in night driving they too frequently deprive other drivers of a vital aid in gauging prospective clearances. There is also a lack of uniformity in the intensity of parking lights. Some, at a short distance, seem like tired glow worms resting where easily distinguishable lights

(Turn to page 110, please)

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Postwar Convertible Car

(Continued from page 29)

2. A tremendous amount of development in the field of top materials assures a wide choice of fabrics that will be weatherproof, fireproof, durable, and colorful. This development has taken place not only in textiles, but in flexible plastics.

3. Even before the war so much progress was made toward the achievement of draftproof fit, when the top was in closed position, that it points the way to even greater accomplishments in that direction.

4. Increase of visibility is largely a matter of bow design so that the fabric can be folded without damage to the rear window. Installation to provide for side windows for rear seat passengers, is not a serious problem.

5. Interior appearance will be greatly improved by incorporating covering for the top-operating linkage. Through changes in bow design, the interior lining will be neatly folded along with the outer cover. The elimination of rattling is largely a matter

of improved design and manufacturing methods.

6. The textile manufacturers can be depended upon to bring out upholstery material that is as soft and pleasant to the touch as the materials used in closed cars, and yet be resistant to all kinds of weather. A greater variety of color, texture, and pattern will be available to the automobile stylist.

7. There has already been a tendency in automotive design to coordinate the efforts of top designers and body stylists in the development of body design while they are still on the drawing board. There is no question but that this tendency will grow in the postwar period, and that the efforts in that direction will be the most vital contribution to the objective of making the convertible a *practical* car. Many of the advanced features in convertible tops that could not be incorporated in a cut-down coupe will be attainable through the incorporation of changes in body lines, and no matter whether the top is raised or lowered, the car will present a streamlined appearance.

All of these developments are *added* features and do not in any way affect the inherent advantages of the open car. Sleek lines, roadability, and low wind-resistance will be retained. These factors will assure a maintenance of the pre-war ratio of convertible sales. And the improvements outlined above are bound to attract a large number of conservative buyers.

Parking Lights

(Continued from page 108)

should be. And besides all that there is lack of uniformity in light distribution due to varying light transmitting materials, shapes, etc.

What can be done about it? There would seem to be several answers, but the purpose now is merely to pose the problem and to call on the experts for its solution.

ASA Starts Project

(Continued from page 104)

rect concern to the war effort and has under development some 68 more. As an indication of the urgency of this job of coordinating the language and practice of drafting rooms, the Navy Department in a recent letter to the chairman of the War Production Board requested that finances be provided to insure this project.

It is proposed that the scope of the work cover the fields of civil, mechanical, electrical, aeronautical, and marine engineering. For all of these fields, the following subjects are to be included: Size of drawings; dimensional indications; methods of specifying threads; symbols, including finishes; lettering; format of drawings; methods of specifying materials; methods of projection; methods of numbering drawings.

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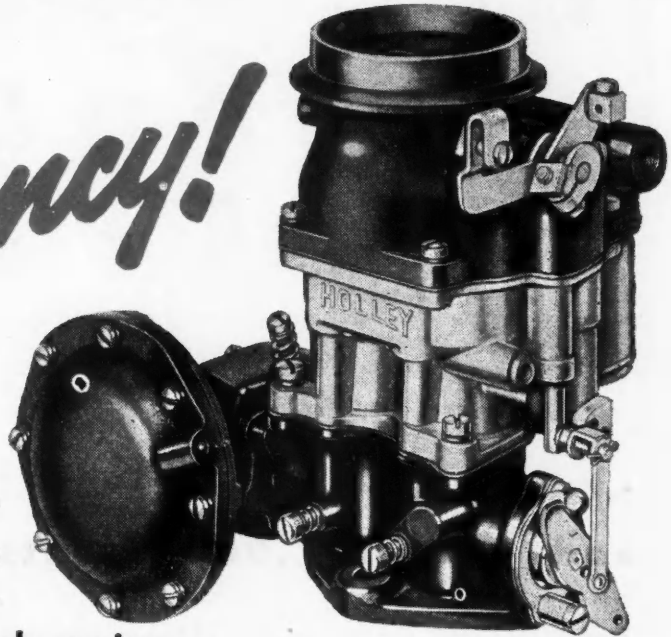
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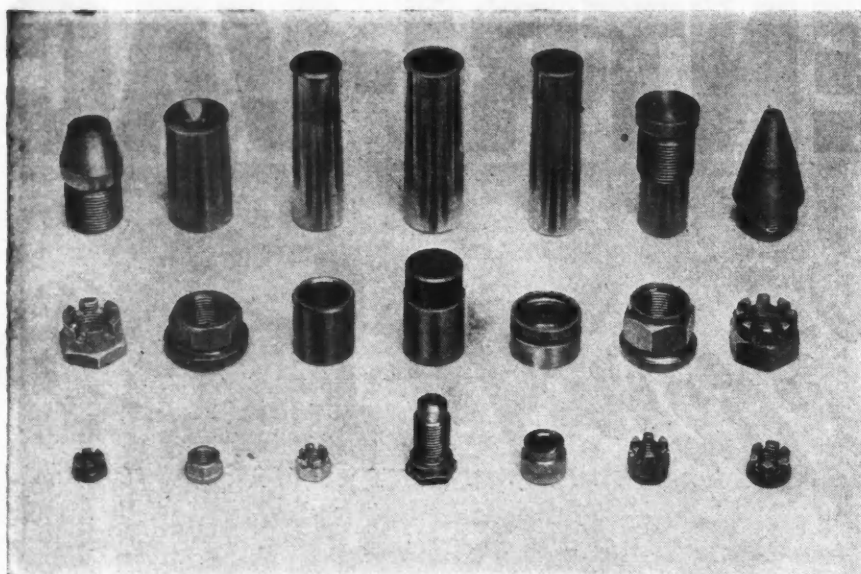
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Laminated Plastics in Automotive Construction

Designers are viewing with considerable interest the development of new materials and their possible applications in the products of the automotive industry. Among these are the varieties of plastics in all their ramifications. In particular, considerable interest has been aroused in the laminated plastics using Fiberglas, product of the Owens-Corning Fiberglass Corp.

Outstanding example of the laminated plastics which should find useful application in automotive construction is "Marcolite" produced by the Continental Can Co. This company acquired the Marco Chemical Co., several years ago and is expanding the useful range of its MR resins for laminates. At the present time Marcolite is produced for the Armed services with Fiberglas and cotton duck as filler materials either separately or in combination. One or more plies of the filler may be employed, depending upon the thickness, strength and other qualities required of the fabricated part. Although the full range of uses has not yet been explored, Marcolite can be made in thicknesses of 0.01 in. or less, and up to 3 in. or more. In size of flat sheets or fabricated parts there is almost no limit since, if necessary, two or more pieces can be bonded together.

During the war Marcolite has been used almost exclusively in flat sheets and in molded parts for aircraft structures and accessories. Parts can be molded in any form, even with sharp corners or angles since neither hot forming (within certain limits) nor molding set up internal strains or stresses, according to the manufacturer.

Although Marcolite has been used only for utilitarian purposes, it is said to offer unlimited possibilities in color and texture at the whim of the product designer. In one form it can be made as a practically unbreakable translucent material, for example, using two plies of Fiberglas.

In weight it is about two-thirds the specific gravity of aluminum and its

(Turn to page 114, please)

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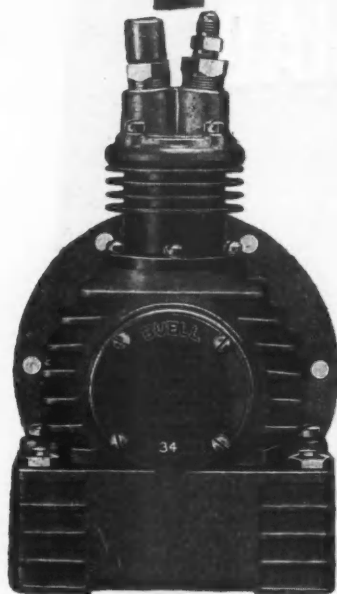
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physical properties are better in some respects, according to tests made by the manufacturer. Abrasion resistance is said to be close to that of porcelain. Although the material is thermo-setting, it is said to be stable at temperatures ranging from minus 70 F to plus 300 F.

Ease of fabrication is an important quality. Parts may be formed without the use of heavy presses or heavy die equipment. The material can be machined, cut, sawed, drilled, lapped, threaded, dimpled, or die stamped.

Among its other possibilities, Marcolite has interesting properties as a soundproofing material.

BOOKS

THE AERONAUTICAL DICTIONARY, by Thomas A. Dickson. Pub. Thomas Y. Crowell Co. 484 pages, illustrated. A completely up to date and inclusive work, this dictionary contains over 6000 terms defined in simple and clear language, covering aerodynamics, meteorology, navigation, piloting, engineering, metallurgy, design, lofting, aircraft construction, and the various other phases of aeronautics. Over 300 drawings and photographs have been included to help clarify the exact meaning.

If a specific operation is being defined, the reader is told not only how, it is done, but why. If an instrument or tool is being defined, where possible, the manufacturer's name is listed. Details such as these make this a practical book. It should be helpful to aviation executives, workers, flyers, and even hobbyists.

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Among other things, this new *forge-ability* constitutes a valuable tool for postwar design. The design engineer concerned with product development for postwar competition will be able to plan for the superiority of forged parts in places where castings previously had to suffice. Whether interested in the improvement of present products or in working out new ideas, you will find it helpful to check with Tube Turns on the latest possibilities of forgings in aluminum and light alloys as well as steel. TUBE TURNS (Inc.), Louisville 1, Kentucky.

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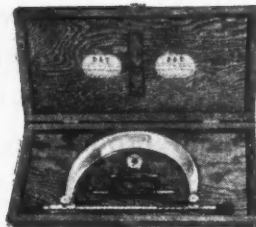
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Sequence Control For Riveting

(Continued from page 42)

various parts of the machine in the required order. With reference to the accompanying schematic diagram, events take place in the control unit and riveter as follows:

- (1) The foot switch is closed by the operator and relay P is energized, closing contacts P-1.
- (2) Closing contacts P-1 energizes the solenoid, opening Ross Valve No. 1.
- (3) Air entering auxiliary cylinder No. 1 actuates the shift mechanism—moving the die button into the punching position, locking the punch, shifting the piston stop block under the main piston, and opening the main cylinder control valve.
- (4) Air entering the main cylinder drives the plunger down into the die bottom, whence it continues to descend—contacting the material and forcing the die over the punch until it is halted by the piston stop block.
- (5) When air pressure in the main cylinder increases sufficiently, pressure switch O closes.
- (6) Closing pressure switch O energizes relay B, closing contacts B-1 and B-3.
- (7) Closing contacts B-1 energizes relay X.
- (8) Energizing relay X opens contacts X-1.
- (9) Opening contacts X-1 de-energizes relay P.
- (10) Opening contacts P-1 de-energizes the solenoid of Ross Valve No. 1 and allows air to exhaust from auxiliary cylinder No. 1.
- (11) When the air pressure in auxiliary cylinder No. 1 is reduced, the spring in the main cylinder control valve opens the exhaust for the main cylinder; then the main cylinder spring returns the plunger to its normal position.
- (12) When air pressure in the main cylinder is reduced, pressure switch O opens.
- (13) Opening pressure switch O de-energizes relay B.
- (14) De-energizing relay B closes contact B-2.
- (15) Closing contacts B-2 energizes relay A.
- (16) Closing contacts A-2 energizes the solenoid of Ross Valve No. 2.
- (17) Air entering auxiliary cylinder No. 2 actuates the shift mechanism—moving the rivet shoe into alignment with the rivet set, removing the main piston stop block and punch lock, and opening the main cylinder control valve.
- (18) Air entering the main cylinder moves the piston down, causing the rivet set to enter the rivet shoe and guiding the rivet shoe and rivet to a position directly above the punch. Continuing to descend, the rivet enters the work and pushes the punch out of the work ahead of it. The punch comes under control valve.

(Turn to page 118, please)



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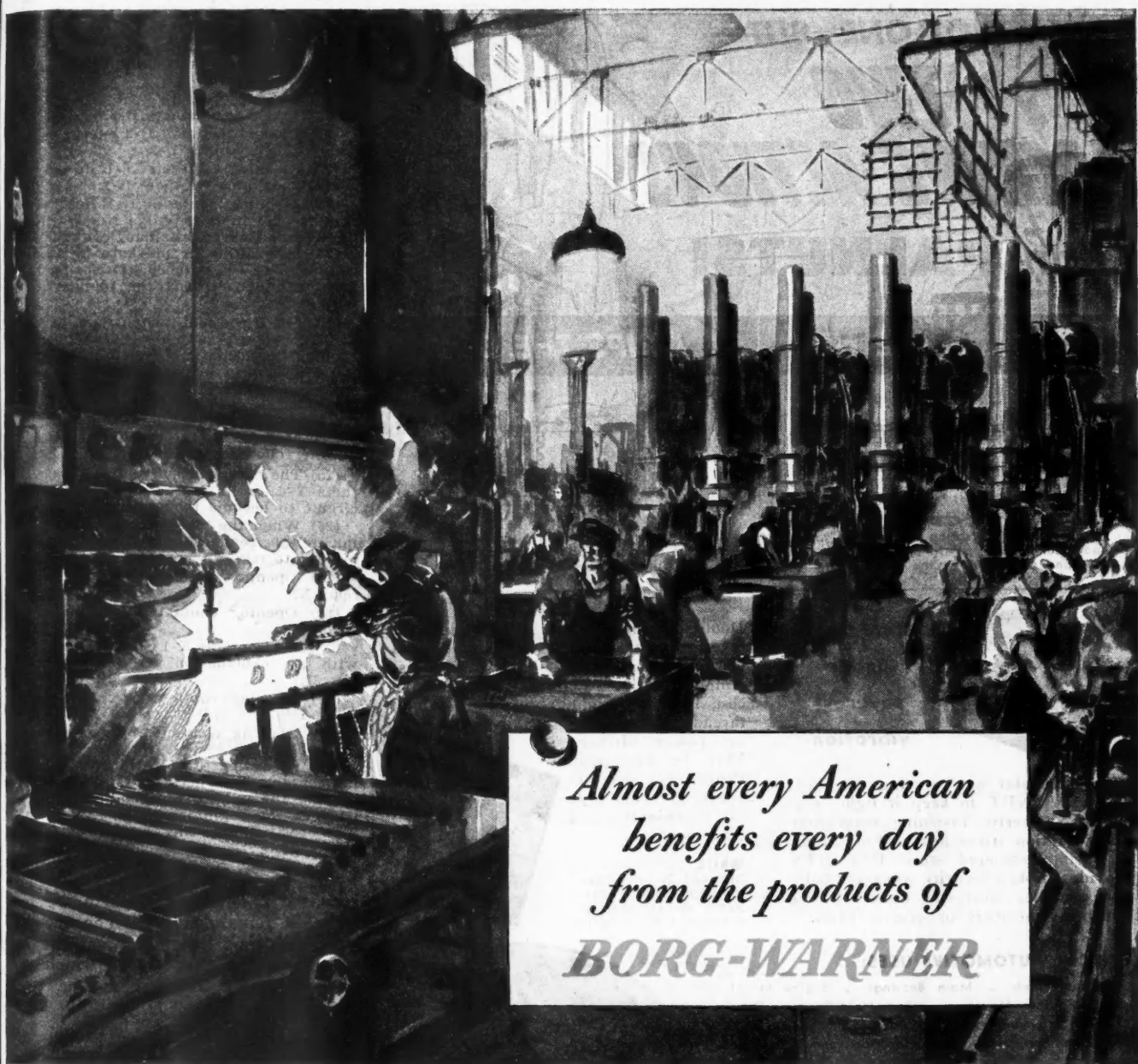


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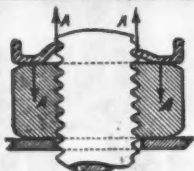
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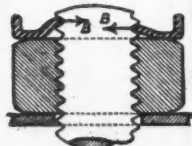


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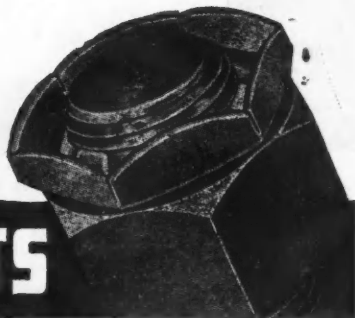
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to rest at the top face of the anvil, and at the extreme end of the stroke the rivet head is formed.

(19) When the air pressure in the main cylinder is sufficiently high, pressure switch O closes.

(20) Closing pressure switch O energizes relay B, closing contacts B-3.

(21) Closing contacts B-3 energizes relay Y, opening contacts Y-1.

(22) Opening contacts Y-1 de-energizes relay R, opening contacts R-1.

(23) Opening contacts R-1 de-energizes the solenoid in Ross Valve No. 2, allowing air to exhaust from auxiliary cylinder No. 2.

(24) When the air pressure in auxiliary cylinder No. 2 is reduced, the spring in the main cylinder returns the plunger to its normal position.

(NOTE: If the foot switch remains closed and the repeat switch remains open, the cycle of operation is complete and the machine becomes inoperative. If the foot switch is open relays X, A and Y return to their normal positions. If the foot switch remains closed and the repeat switch is closed at or before the end of operation No. 24, the following events occur):

(25) The energizing of relay Y closes contacts Y-2 and Y-3, and causes the timing circuit to become inoperative.

(26) When the plate current of the thermionic tube reaches a value sufficiently high to operate relay T, contacts T-1 opens.

(27) Opening contacts T-1 de-energizes relay X.

(28) Opening contacts X-2 de-energizes relay A.

(NOTE: Contacts X-1 closes in accordance with the explanation given for operation No. 31.)

(29) Opening contacts A-2 de-energizes relay Y.

(30) Opening contacts Y-2 connects the timer circuit.

(31) Returning to operation No. 28: Closing contacts X-1 energizes relay P, thus returning the unit to the condition that existed at the beginning of operation No. 1, when relay P was energized by closing the foot switch.

This sequence of operations will be repeated as long as the foot and repeat switches remain closed. The speed of the operations depends upon the setting of the potentiometer which controls the time constant of the timer circuit.

With manual controls, a single Erco 2002 riveter can handle about 10 normal-size airplane panels in an eight-hour day. With the new electronic sequence control unit, the same machine will turn out approximately 12½ normal-sized airplane panels in an eight-hour day.

(Turn to page 120, please)

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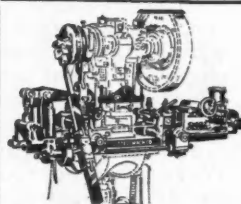
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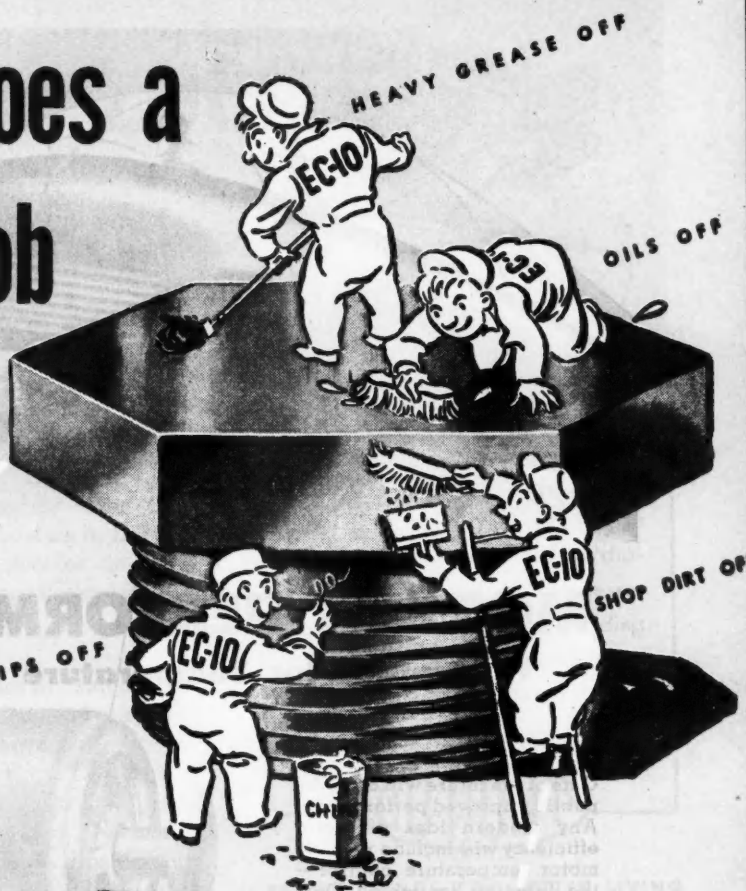
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This combination makes it possible for each eight hour shift to produce an average of 9700 fuse plugs with only 1/10 of 1% rejects — a step up in production of 15%.

The following is the actual case history of this operation.



FUSE PLUGS (BOMB)

PENNSALT EC-10 AND PENNSALT K-7 CLEANING PRIOR TO ZINC PLATING AND IRIDITE DIP

PROBLEM

To clean steel bomb Fuse plugs free of oils, greases and filings prior to zinc plating and subsequent "Iridite" dip coating.

EQUIPMENT USED

A 200 gal. solvent dip tank followed by a spray rinse and a 325 gal. reverse current alkali cleaning tank followed by a dip rinse tank.

METHOD

PART 1 — PRECLEANING

1. Use Pennsalt EC-10 concentrated, room temperature; soak for 30 seconds.
2. Cold water spray rinse.

PART 2 — ANODIC CLEANING

3. Use Pennsalt K-7 at 50 to 100 amps./sq. ft. at 8 oz./gal., 200° F. for 30 seconds.
4. Hot water rinse.
5. Muriatic acid dip.
6. Cold water rinse.
7. Zinc Electroplate.
8. Hot water rinse.
9. Hot "Iridite" dip and then dry air.

Special Chemicals Division Products

Acid-, Alkali-, and Solvent-proof Cements • Lead Fluoroborate Concentrates • Fluoboric Acid • Acid, Alkali and Solvent Emulsion Type Cleaners • Paint Strippers • Pickling Agents.



"THE PENN SALT MAN"
FIRST A TECHNICIAN
... THEN A SALESMAN

Penn Salt's Special Chemicals Division men are well trained in the application of chemicals to industry's problems. If you have a metal cleaning problem, don't hesitate to seek the advice of "THE PENN SALT MAN." He will advise you without obligation.

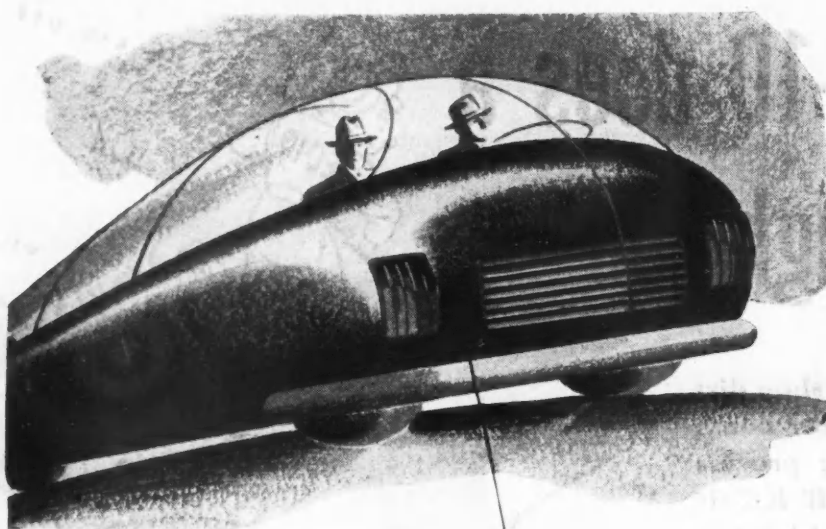
SPECIAL CHEMICALS DIVISION

PENNSYLVANIA SALT
MANUFACTURING COMPANY

Chemicals

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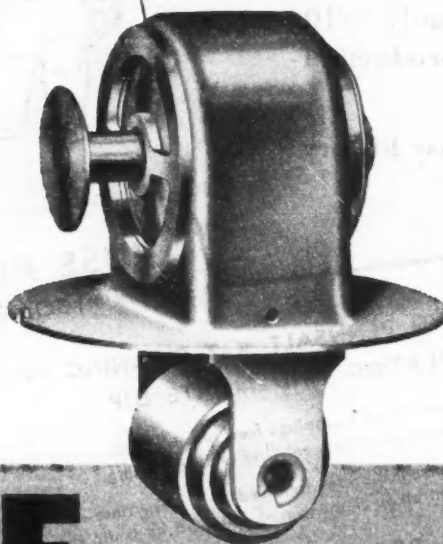


MODERN PERFORMANCE

Through Motor Temperature Control

Cars of the future will offer the public improved performance. Any modern idea of motor efficiency will include positive motor temperature control—the function for which Dole Thermostats are designed.

Dole Thermostats assure the quick warm-up which contributes to smooth performance, and a reduction of crank case dilution—with savings of gasoline, oil and the motor.



DOLE

THERMOSTATS

THE DOLE VALVE COMPANY

1901-1941 Carroll Avenue, Chicago 12, Illinois

LOS ANGELES

DETROIT

PHILADELPHIA

Savings in Erco parts with the control unit can be determined by an examination of the following table:

Name of Part	Cost	Manual Control	Electronic Control
Die button.....	\$3.20 ea.	27	9
Punch.....	1.15 ea.	27	9
Control cable.....	1.50 ea.	2	1
Piston stop.....	18.00 ea.	2	1
Set links.....	18.00 ea.	2	1
Pair shoes.....	13.75 ea.	2	1
Slide rod (Safety)...	3.75 ea.	2	1
Ball bolt.....	3.00 ea.	6	1
Shift rod.....	13.00 ea.	2	1

This table was made up from records kept over a period of six months for two Erco riveters, one of which was manually controlled, while the other was electronically controlled. If the given data are totaled, it will be found that the manually-controlled machine parts cost \$250.95, while the electronically-controlled machine parts cost only \$111.65. This indicates a saving of \$139.50 for a single electronic control unit during a period of six months.

Ceiling on Ford Tank Engine Production

Coincident with cutbacks in tank production expansion programs, Ford Motor Co. production of tank engines will be placed under a ceiling of 55 engines a day. Previous commitments had been set at approximately double that number. Present output is 48 engines a day and the 55-engine schedule is expected to be reached in October. As a result of the reduction in the anticipated rate, several machining operations which were to be moved to Ford's Buffalo plant now will remain at the Lincoln plant.

Vibron Resins

A family of liquid plastics, known as Vibron resins, has been originated by the United States Rubber Co. The new materials, when combined with spun glass or other fabrics, are said to have a strength per pound equivalent to that of steel. Characteristic differences in physical properties, such as hardness, flexibility and abrasion in finished products, can be obtained by using different types of these resins.

MILLHOLLAND

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MILLING - TAPPING

1/2 to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

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Long Island City, N. Y.

WACO CHOOSES DU PONT "LUCITE"

FOR ITS NEW CG-15A GLIDER



Crystal-Clear Transparency Affords Maximum Vision

LAATEST GLIDER to come off the production lines of Waco Aircraft is the new CG-15A. A large section of the nose is made of transparent Du Pont "Lucite" methyl methacrylate resin. Waco engineers specify "Lucite" because of its crystal-clear transparency, dimensional stability, its outstanding weather-resistance and its ability to be formed into extreme contours.

The pilot and co-pilot who operate this motorless craft enjoy maximum vision at all times. "Lucite" possesses good optical qualities and transmits over 92% of light rays. Although the

specific gravity of "Lucite" is only 1.18, it is exceptionally strong and has good shatter-resistance. In addition, it does not discolor or craze, even under prolonged exposure to extreme atmospheric and temperature changes.

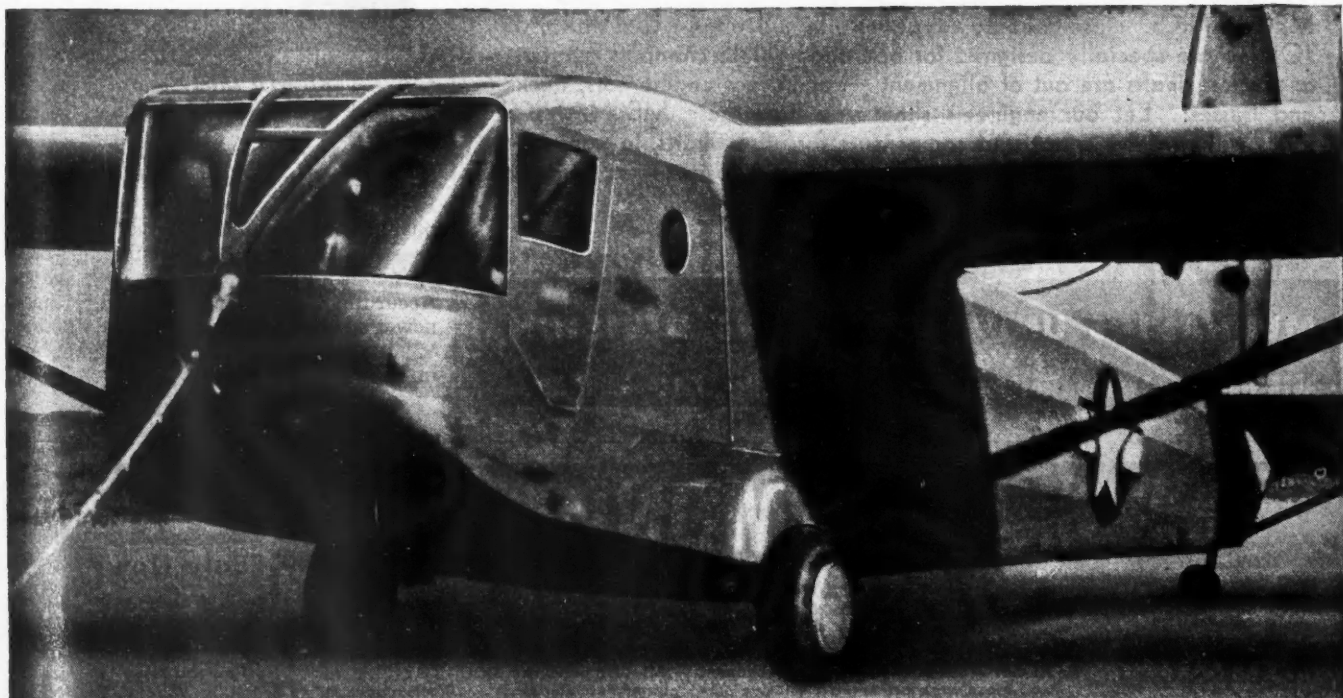
Limited quantities of "Lucite" are available for experimental purposes, subject to WPB approval. For information, write: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 South Broadway, Los Angeles 3, Calif. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

The CG-15A Waco Glider is equipped with nine transparent pieces in the nose and a landing-light cover on the left wing made of "Lucite" as shown in this diagram. Because "Lucite" possesses sufficient rigidity, metal "holding strips" or "frames" for the enclosures are narrower, thus contributing to better vision.

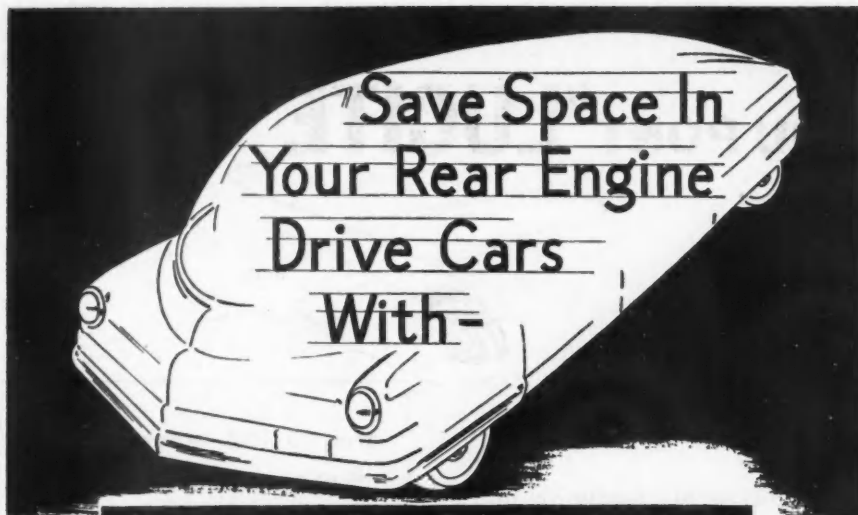


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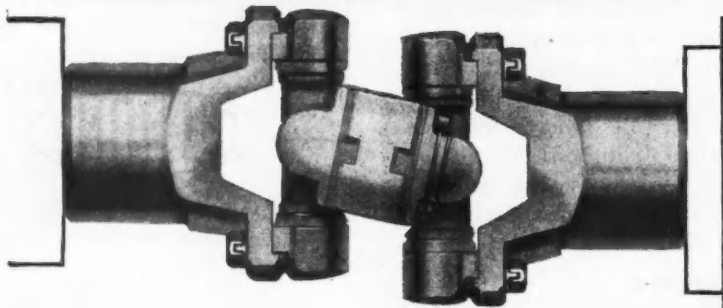
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FOR PLASTICS.. CONSULT DU PONT



MECHANICS *Roller Bearing* UNIVERSAL JOINTS



MECHANICS close-coupled type Roller Bearing UNIVERSAL JOINTS are specially designed for operation within cramped quarters, and where shafts are out of alignment — as in rear engine cars, trucks and busses. Let our engineers show you how these MECHANICS joints will conserve space and compensate for offset shafts, in your new or improved models. These joints fit into spaces that engineers formerly considered too short for universal joints.



MECHANICS UNIVERSAL JOINT DIVISION

Borg-Warner Corporation

2020 Harrison Avenue, Rockford, Ill. Detroit Office, 7-234 G. M. Bldg.

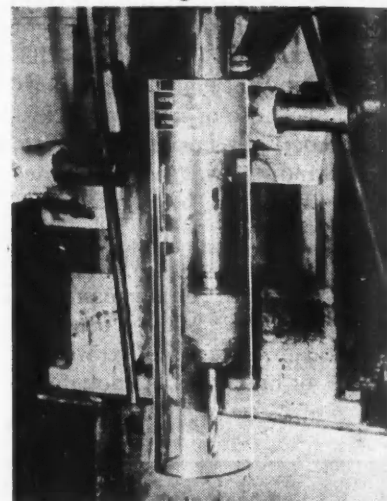
New Products

(Continued from page 86)

enclosed in an evacuated glass envelope to cause heating of the thermocouples by radiation, to minimize room temperature effects, and to prevent deterioration of the elements. Changes in electric furnace temperatures are anticipated and corrective steps taken to minimize the cyclic swings in temperature characteristic of most furnace controls.

Transparent Safety Guards

Kleervu safety guards, made by Wright-Austin Co., Detroit, Mich., are completely transparent and allow full view of the machine and work. They provide protection for the worker



Kleervu safety guard

without hindrance to any kind of operation. The material from which Kleervu guards are made is a transparent, heavy-gauge plastic which can be sawed or drilled as easily as wood, or molded into practically any shape. According to the manufacturer, these new guards are available in a number of standard sizes, and can be supplied in special sizes and shapes.

(Turn to page 124, please)



Actual Size Photo
3 Carat Size—Common
1/4" Shank—\$36.00 ea.

LOC-KEY-SET
by Patented Process
U. S. Pat. 2,351,741

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RE-SET-ABLE • BIG-HEAD-NIB

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● RE-SET-ABLE adds to life of your diamond . . . More work per carat. Exclusive patented setting is tender to the diamond . . . Holds firmly . . . Protects from damage . . . Guards against breakage.

No. 24 CN RE-SET-ABLES are now selling in 100 lots. Ask for easy No. 4 Catalog and Grinder's Instruction Card. Shows sizes to fit your machines. Tools backed by service unequalled.

All diamonds are LOC-KEY-SET for immediate shipment . . . Tools numbered in units of 1/8 carat (No. 1 size) and lettered to denote quality of diamond and style of mounting . . . 3 grades—Common (C), Medium (M), Select (S). (24-hour resetting service \$1.00 postpaid.) Bigger stones in C grade are genuine economy in diamond use. For large wheels we recommend No. 60-CN.

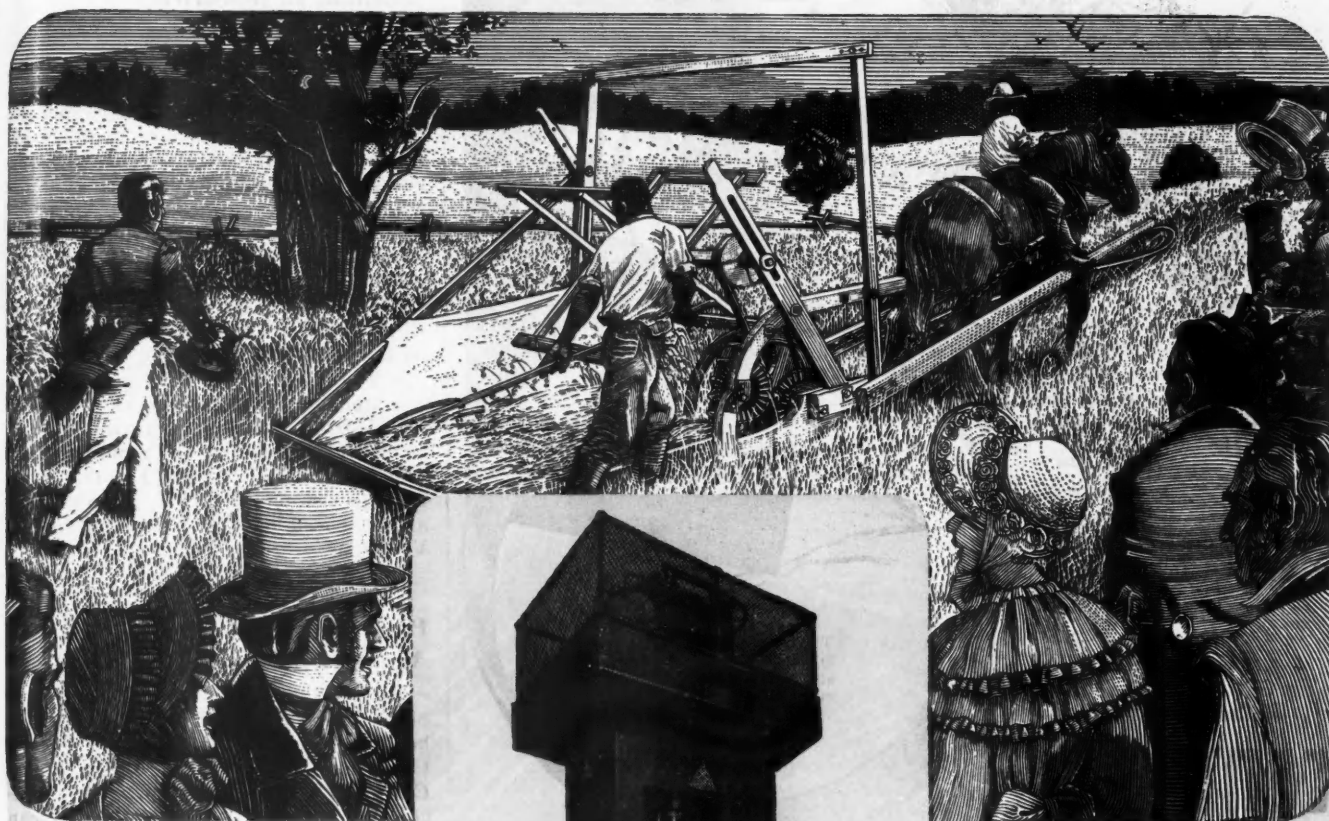
Equip Now with

"RE-SET-ABLE"

Diamond Tools on Your Precision Grinding Production Line



DIAMOND TOOL COMPANY, Not Inc. SHELDON M. BOOTH, Pres.
938 E. 41st Street CHICAGO 15, Ill.



46 ANCESTORS TOOK OFF THEIR HATS



On that bright July day in 1831 when Cyrus McCormick publicly operated his mechanical reaper so successfully, the ghosts of 46 previous machines stood rusting in American fields. For McCormick was not the first to build a reaper—the 46 prior patents, actually granted, attest to that. Many of those predecessors actually worked, after a fashion, but it remained for McCormick to make practical the long-sought idea of mechanical harvest.

Nor was Clearing the first to build a press for forming metal—yet Clearing Presses mark a revolutionary new era in press techniques and standards.

Clearing made possible stampings to tolerances of undreamed of limits and of unprecedented size. Faster work cycles raised rates of production. These and other Clearing contributions put today's press operations far ahead of yesterday's.

If you are seeking lower costs or greater accuracy put your problem up to Clearing. We've already done many things that other folks said couldn't be done with presses, and it won't cost you anything to find out what we can do for you. Write to Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois.



CLEARING ★



A SINGLE CENTRAL ALL-SIZE HOSE CLAMP

FITS OVER 100 DIFFERENT HOSE SIZES

SEND FOR

**FREE
SAMPLE**

No. 45-5A

• Like the jungle lion, the ALL-SIZE is tops in the field. It has unmatched clamping power; fastest clamping action; plenty of take-up; goes on or off in the least time, without disconnecting the hose line; is easiest to use in hard-to-get-at places; is leak-proof, rust-proof, self-locking; won't strip or loosen.

• Best of all—because a single size ALL-SIZE does fit more than a hundred different hose sizes—it offers every advantage for both production and service use, saving time and labor on every operation, and giving complete satisfaction at all times . . . The Central ALL-SIZE is standard for U. S. Army and Navy vehicles.

CENTRAL EQUIPMENT CO. 900 S. WABASH AVE.
CHICAGO 5, ILLINOIS

For Ignition Switch Service; Directional Switches; Dove Tails

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Air Cleaners—Oil Bath and Pre-Cleaners for Engine Protection

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SPRINGS

"Measurably Better"

Service Springs

FOR ALL CARS AND TRUCKS

SERVICE SPRING COMPANY • INDIANAPOLIS 6, INDIANA

Addition to Goodrich Line of V-Belting

The B. F. Goodrich Co., Akron, Ohio, has added an "A" section to its line of open end V-belting. The company's open end V-belting is now available in four standard sections of the same cross-sectional dimensions as endless V-belts, allowing use of standard sheaves. These sizes are the "A" with 17/32-in. top width and 5/16-in. thickness, "B" with 21/32-in. top width and 7/16-in. thickness, "C" with 3/8-in. top width and 5/8-in. thickness, and "D" with 1 1/4-in. top width and 3/4-in. thickness.

Extension of the application of open end V-belting has been made possible by development of a new fastener named "Flex V" by the Flexible Steel Lacing Company. This fastener can also be used on "B" section open end V-belting.

Paint Protects Wood Against Fire Hazard

A paint which protects wood and other materials against fire hazard is being marketed by the General Detroit Corp. and the General Pacific Corp. Called Fi-Repel, it is shipped as a concentrated paste. After dilution it can be applied with a brush or spray gun to the surface to be protected. One concentrated gallon, at standard dilution, will cover as much as 185 sq ft with two coats. Standard color is bone-white, but tints may be added if desired.

Skin-Protector Compound

Cadet Laboratories, Worcester, Mass., has brought out a skin-protector compound named Sealskin. This compound, applied but once daily, is said to form a durable, invisible coating over the skin that acts as a preventive against skin infection, eruption and irritation for workers coming in contact with petroleum products, coal tar derivatives, esters, acids, alkalis, caustics, degreasing and many other aqueous solutions used in the industry.

• POSITIONS OPEN •

**DIESEL ENGINEERS
DESIGNERS and DRAFTSMEN
FOR DEVELOPMENT WORK**

ON
New High Power Engine • POST-WAR POSSIBILITIES •
Eastern Location • Address Box 27; care of this Magazine
Statement of availability required.



STAMPINGS

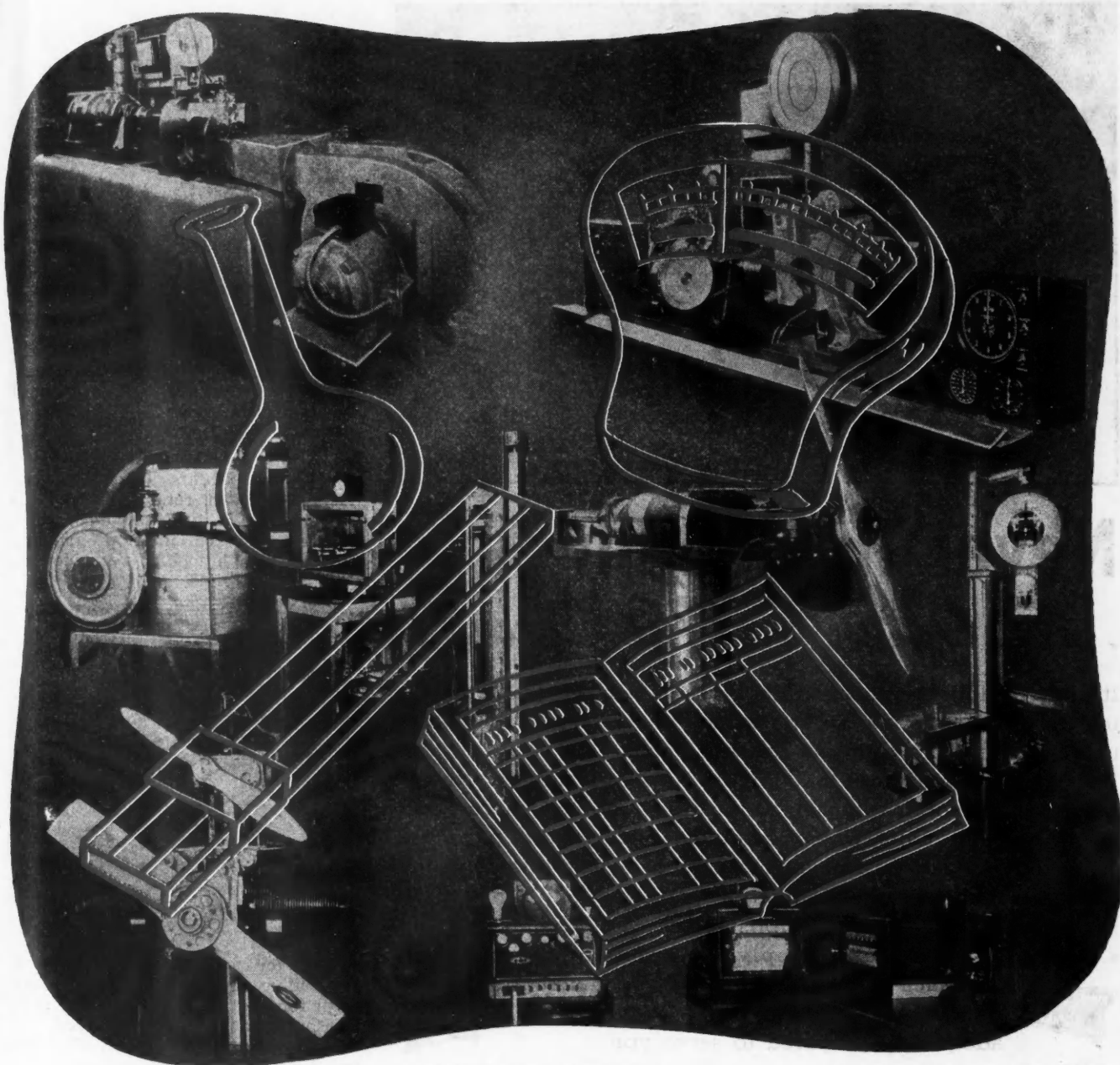
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WORCESTER STAMPED METAL CO.
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BUILDERS OF GASOLINE ENGINES EXCLUSIVELY

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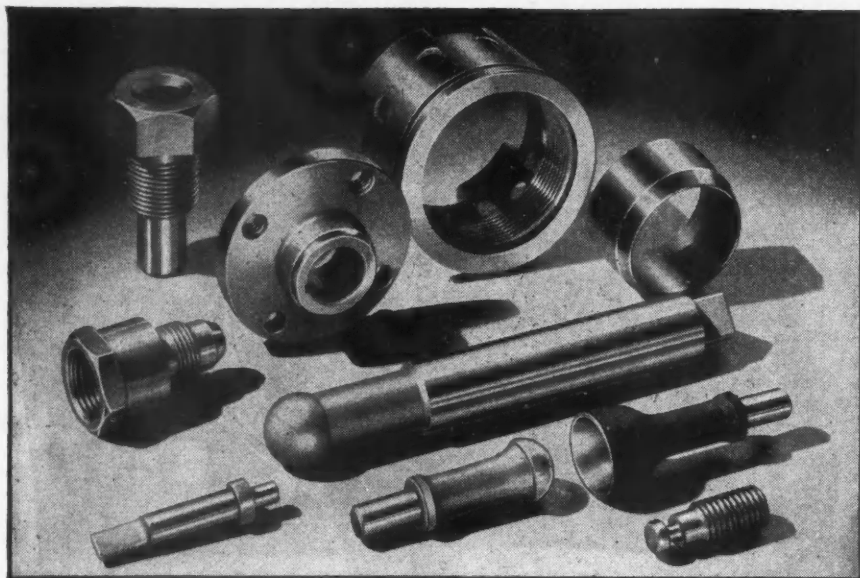
Outboard Motors • Marine Engines • Portable Industrial Engines • Aircraft Engines • Aircraft Auxiliary

Built to Use . . . Built to Last

May 15, 1945

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125



Never In Headlines Often In The News!

It's interesting how some things are taken for granted. For instance, the superlative performance of screw machine products made by The Chicago Screw Company.

These precision parts function faultlessly in aircraft, trucks, tractors, automobiles, diesel and marine engines, radios, and in many other units where hardened and ground parts are utilized. Our parts are never mentioned in headlines, but the units of which they are an integral part are often in the news because of sensational accomplishments . . . When YOU need a dependable source of supply for precision-made, close-



tolerance screw machine products, you'll find us an alert, progressive organization adequately prepared to serve you.



THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE CHICAGO 24, ILL.

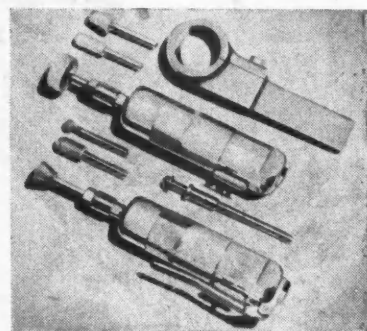
New Production Equipment

(Continued from page 60)

an abrasion-resistant alloy steel. The new nozzle is guaranteed for 1500 hours of service when used with steel shot or grit and for 750 hours when used with silica sand.

Improved blasting efficiency, decreased air consumption and low hourly costs are among the advantages claimed by the manufacturer.

FORSS PNEUMATIC TOOL CO., Rockford, Ill., is introducing two new air-operated rotary file and die grinders, Models 1007 and 1008, which are designed for internal grinding when used as a tool post grinder, as



Forss rotary file and die grinders

well as for finish die grinding and rotary filing. The two models are alike except for the throttle control, one having a button and the other a lever.

Specifications show a speed of 25,000 rpm, length of 6½ in., diameter 1½ in., weight 1 lb, elastic wheel capacity 1½ in., verified wheel 1 in. Standard equipment is a collet chuck and extra equipment includes a flexible sleeve collet, a wheel arbor, tool post clamp, and extension spindles.

FELT

Men who know FELT are available to assist you in selecting the exact FELT for your requirements. Their success is built on ability to make customers as well as to sell FELT.

American Felt Company

General Offices:  GLENVILLE, CONN.

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PJ

.. for over 40 years
**THE PIONEER
MANUFACTURER OF**

AUTOMATIC CHUCKING EQUIPMENT

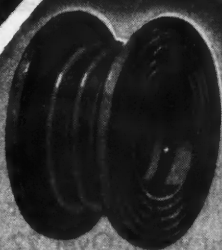
POTTER & JOHNSTON MACHINE CO.

PAWTUCKET, RHODE ISLAND

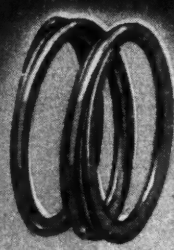
Only 4 Parts



Ferrule insures even distribution of spring pressure.



Specially compounded Flexible Synthetic Rubber Bellows.



Helical spring. Precision made, of metal suited to job.



Ferrule—also made with metal or finish best suited to job.

FACTORY ASSEMBLED

The JOHN CRANE Bellows PUMP SEAL

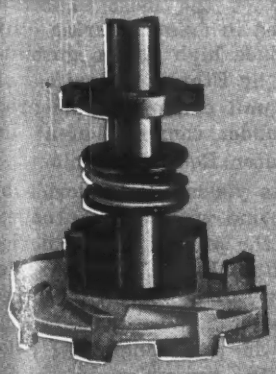


SIMPLE . . .
. . . FLEXIBLE



Nothing could be easier to install than this one-unit assembly. Simply drop the John Crane Bellows Seal into place *either end first*; does not touch shaft because sealing contact is on the end flanges. *No adjustment is required*—quick and foolproof installation on the production line is assured.

The design of the John Crane Bellows Seal makes it *independent of shaft condition*; despite rust and scale it *always flexes automatically* to adjust for washer wear, shaft vibration and end play. Does not require a clean shaft for efficient performance; insures easy installation in the replacement field.

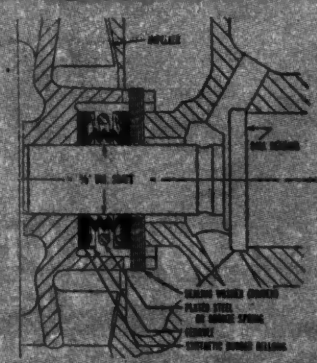


Seal—Free Height

The John Crane Bellows Seal is *standard equipment* on Jeeps, Tanks and Trucks for these three basic reasons:

- Foolproof installation
- Trouble-free performance
- Long life

Design Engineers should have Bulletin No. 2 for quick reference on seals.



Typical Installation

CRANE PACKING COMPANY

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Washers and Stampings

ALL KINDS - FOR ALL PURPOSES!

No matter what your requirements may be . . . washers of any size or shape, any material or finish, in any quantity . . . we can supply or make what you want. Over 22,000 sets of dies available for producing standard and special sizes.

Our facilities are at your service.



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WORLD'S LARGEST PRODUCER OF WASHERS
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Product and Experimental Engineer on Upholstered Seating. Unusual postwar opportunity with manufacturer in Buffalo, New York. Requires experience in bus, aviation, railroad and automotive seating, fabrication of metal frames, upholstering and painting. Statement of availability required. Age 35-55—Salary open—Write Box 36, Chilton Company, Chestnut & 56th Sts., Philadelphia 39, Pa.

UNIVERSAL MIDGET TOOLS: DANDY SIXTEEN PIECE SET: Midget Pliers, Diagonal Cutters, Four Midget End Wrenches, Needle-nose Pliers, Screwdriver, Six Punches and Chisel, Round File, Midget Crescent Wrench. \$14.85. **IMMEDIATE SHIPMENT—Overnight by Air to Anywhere USA.** Remit today. Price List and Order Blank Free. Write Now for Dealers Quantity Discounts. **UNIVERSAL TOOL COMPANY, 1527 Grand AAL, KANSAS CITY, MO.** Remember: We have it, can get it, or it isn't made.

HELP WANTED — DESIGNERS AND DRAFTSMEN: EXPERIENCED ON HEAVY MACHINERY ENGINES, AUTOMATIC MACHINERY, ALSO HYDRAULIC AND PNEUMATIC EQUIPMENT. VITAL WAR AND POSTWAR PROJECTS. HIGH SALARIES. STATEMENT OF AVAILABILITY REQUIRED. YORK RESEARCH CORP., 63 PARK ROW, NEW YORK 7, N. Y.

Advertising Note

Appointment of Florez, Phillips & Clark, Inc., Detroit, as advertising counsel for the Motor State Products Co., Ypsilanti and Detroit, Mich., was announced by A. J. Seedorff, president of Motor State, pre-war makers of the "push button" top.

New Process Developed for Making Ethyl Chloride

A new process for making ethyl chloride, one of the most important chemicals used in manufacturing ethyl fluid to produce high octane gasoline, is announced by Ethyl Corporation. A \$750,000,000 unit employing this process is now under construction at the company's Baton Rouge, La., plant.

The process yields ethyl chloride by reacting chlorine with waste products from one of the present ethyl chloride units at Baton Rouge. It was developed in view of the "tight" supplies of both alcohol and ethylene, compounds used in producing ethyl chloride, through two present processes.

The principal use of ethyl chloride is in making tetraethyl lead by combining it with an alloy of lead and sodium. Tetraethyl lead comprises about two-thirds of ethyl fluid and does the work in taking out the "knock" in gasoline.